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NASA TECHNICAL MEMORANDUM

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TRAJECTORIES FOR THE APOLLO SOYUZ TEST
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PRELIMINARY FLIGHT TRAJECTORIES FOR THE APOLLO SOYUZ TEST PROJECT

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April 1973



NASA

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DEFINITIONS AND SYMBOLS

Aerodynamic Heating Indicator

$$\int \frac{qV_r}{\pi/2 - |\alpha_t|} dt$$

q = dynamic pressure
 V_r = relative velocity
 α_t = total angle of attack

Aerodynamic Load Indicator

Product of dynamic pressure and angle of attack.

Altitude

Vehicle altitude above the reference ellipsoid measured along the geocentric position vector.

Angle of Attack, Pitch

Angle between the pitch plane component of the relative velocity vector and the longitudinal axis of the vehicle, measured positive nose up.

Apogee Altitude

Apogee height of the osculating conic above the reference ellipsoid, referenced to the equatorial radius, 6378166 meters.

Attitude Command

Eulerian angle command, derived by the guidance system and transmitted to the control system.

Attitude Error

Difference between the vehicle attitude (pitch, yaw and roll Eulerian angles) and the vehicle attitude command.

Axial Force

Component of the resultant aerodynamic force along the vehicle longitudinal axis (X axis of PASCS 8a), measured positive toward the tail of the vehicle.

Descending Node Argument

Angle measured in the equatorial plane between the orbit descending node and the space fixed launch meridian defined at Guidance Reference Release.

Drag

Component of the resultant aerodynamic force along the relative velocity vector, measured positive opposite to the velocity vector.

Dynamic Pressure

$$\frac{1}{2} \times (\text{Density}) \times (\text{Relative Velocity})^2$$

DEFINITIONS AND SYMBOLS (CONT'D)

Earth Fixed Position

Position vector/components in an earth-fixed pad-centered plumline coordinate system. The X_e axis is coincident with the reference ellipsoid normal, positive upward. The Z_e axis is parallel to the earth-fixed aiming azimuth and is positive downrange. The Y_e axis completes a right handed system. (PASCS 10)

Earth Fixed Cross Range

Y_e component of PASCS 10 position vector.

Earth Fixed Flight Path Angle

Angle between the earth fixed velocity vector and the earth fixed geocentric position vector (PASCS 11), measured positive downrange from the position vector.

Earth Fixed Velocity

Velocity vector/components in PASCS 10.

$$\sqrt{\dot{X}_e^2 + \dot{Y}_e^2 + \dot{Z}_e^2}$$

Eccentricity of the osculating conic.

Flight Azimuth

Angle defining orientation of the space fixed coordinate system downrange axis, Z_s , at Guidance Reference Release, measured positive east of north in plane normal to the space fixed X_s axis.

Geocentric Declination

Angle between the geocentric radius vector and the true equatorial plane, measured positive north of the equator.

Geodetic Latitude

Angle between the reference ellipsoid normal through the point of interest and the true equatorial plane, measured positive north of the equator.

Ground Range

Surface distance from launch site to the sub-vehicle point, positive east ($0^\circ - 180^\circ$).

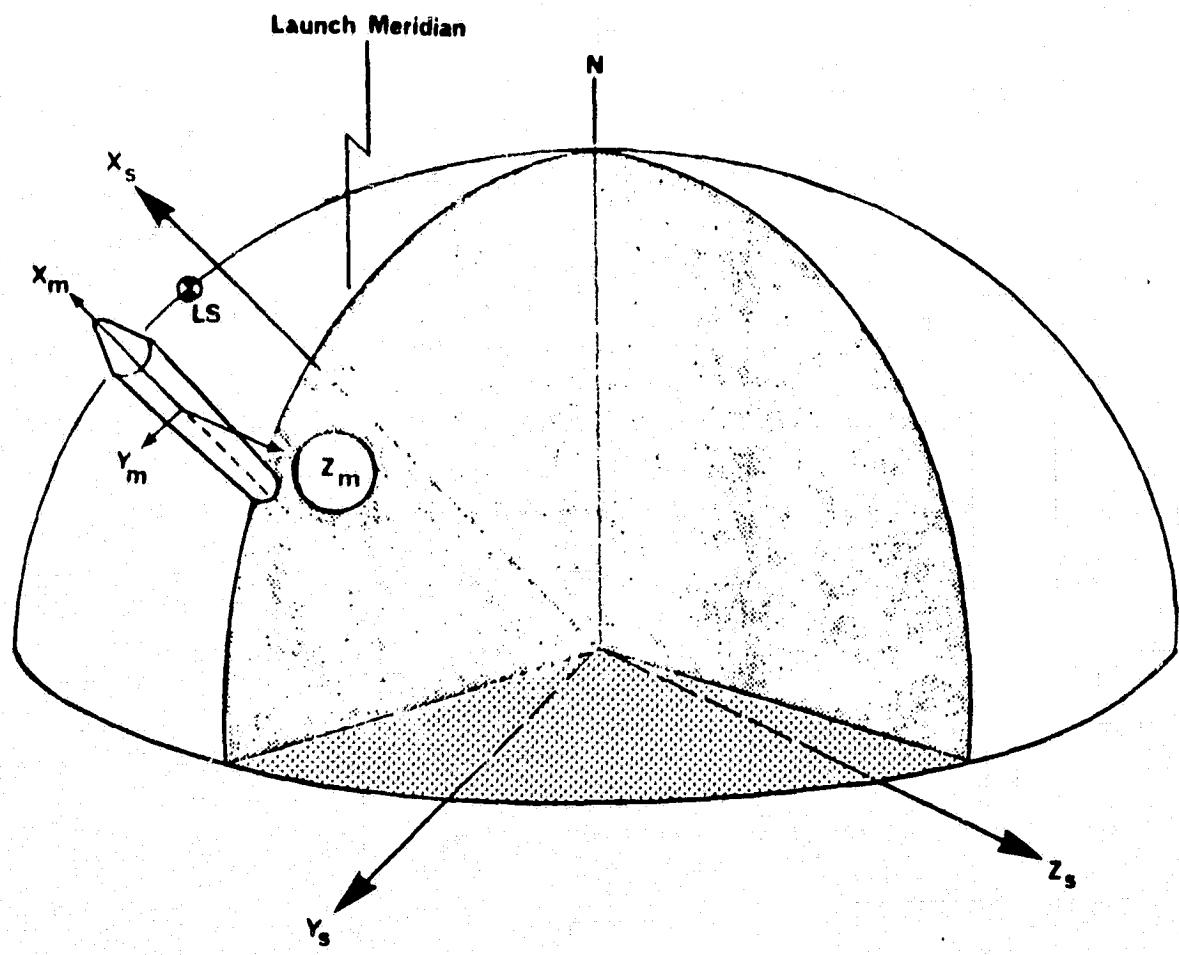
Inclination

Angle between the instantaneous flight plane and the equatorial plane.

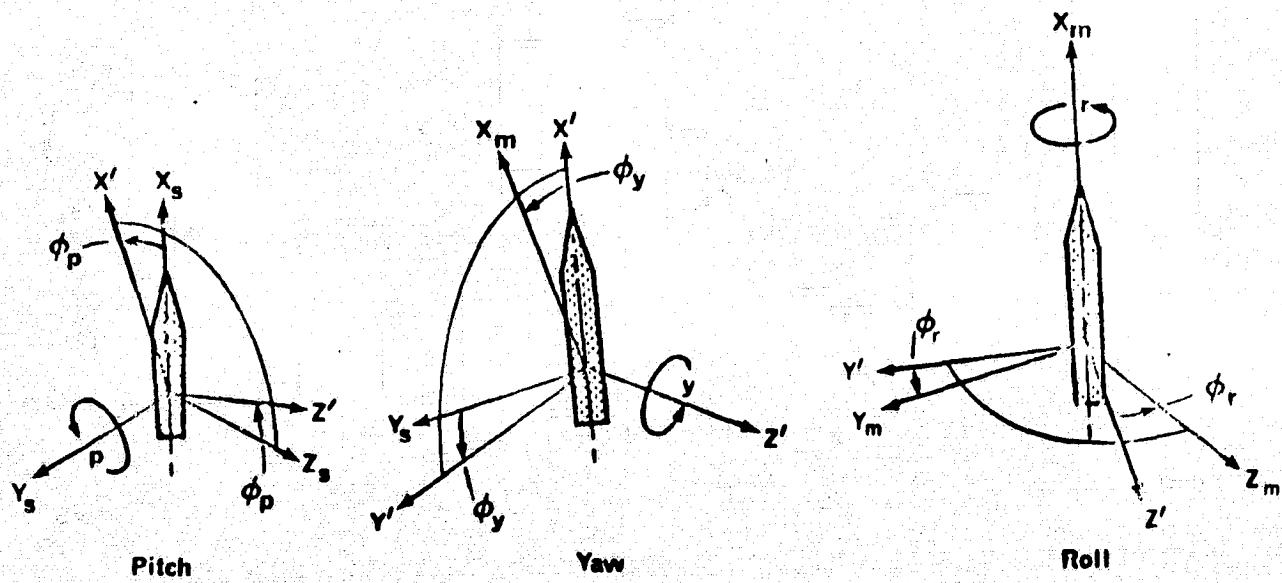
Inertial Range Angle

Angle between the instantaneous space fixed position vector and the space fixed position vector at Guidance Reference Release.

DEFINITIONS AND SYMBOLS (Cont'd)



$$\bar{x}_m = (\phi_r)_1 (\phi_y)_3 (\phi_p)_2 \bar{x}_s$$



DEFINITIONS AND SYMBOLS (CONT'D)

Longitude	Angle between the Greenwich meridian plane and the projection of the geocentric position vector in the equatorial plane, measured positive east of Greenwich.
Longitudinal Acceleration	That part of the total measurable acceleration directed along the longitudinal axis of the vehicle.
Mach Number	(Relative Velocity) \div (Local Speed of Sound)
Mass	Mass of the vehicle.
Navigation Coordinate System	This system is identical to PASCS 13 with ideal navigation.
Normal Force	Component of the resultant aerodynamic force normal to the vehicle X axis, and in the X-Z plane (PASCS 8a), measured positive toward Position I.
Perigee Altitude	Perigee height of the osculating conic above the reference ellipsoid, referenced to the equatorial radius, 6378166 meters.
Period	Period of the osculating conic.
Pitch, Yaw, Roll (Inertial)	Eulerian angles of vehicle attitude measured with respect to the space fixed coordinate system. Vehicle attitude is defined by the ordered rotation of pitch, yaw, and roll, respectively. (See illustration)
Radius	$\sqrt{x_s^2 + y_s^2 + z_s^2}$
Range	Surface distance from launch site to the sub-vehicle point, positive east ($0^\circ - 180^\circ$).
Relative Vehicle Attitude	Pitch, yaw and roll angles of the vehicle in an earth relative system. The roll axis is the projection of the velocity vector in the local horizontal plane; the yaw axis is in the local vertical plane, positive toward the center of the earth; the pitch axis completes a right handed system. Vehicle attitude is defined by ordered rotation-pitch, yaw and roll, respectively.

DEFINITIONS AND SYMBOLS (CONT'D)

Relative Velocity	Velocity relative to the atmosphere (includes wind velocity).
Semi-Major Axis	Length of the chord in the orbit plane connecting the apogee and the perigee of the osculating conic.
Space Fixed Position	Position vector/components in a spaced fixed, earth centered, plumbline coordinate system defined at Guidance Reference Release. The Xs axis is parallel to the reference ellipsoid normal which passes through the launch site. The Zs axis is parallel to, and positive in the same direction as, the earth-fixed firing azimuth. The Ys axis completes the right handed system. This is Project Apollo Standard Coordinate System 13. (PASCS 13.)
Space Fixed Cross Range	Ys component of PASCS 13 position vector.
Space Fixed Flight Path Angle	Angle between the space fixed velocity vector and the radius vector (PASCS 13), measured positive downrange from radius vector.
Space Fixed Velocity	Velocity vector/components in PASCS 13.
Space Fixed Velocity Magnitude	$\sqrt{\dot{X}_s^2 + \dot{Y}_s^2 + \dot{Z}_s^2}$
Time	Instantaneous flight time referenced to first motion.
Thrust	Total effective thrust magnitude,
True Anomaly	$\sqrt{FTX^2 + FTY^2 + FTZ^2}$
Velocity Vector Azimuth	Angular displacement of the vehicle C.G. from the perigee, measured in a counter-clockwise direction.
Weight	The angle between the velocity vector projection on the earth's surface and true north.
	Weight of vehicle in pounds.

DEFINITIONS AND SYMBOLS (CONT'D)

X_4 Coordinate System

Vehicle c.g. displacement components in a space fixed, right handed, target coordinate system with its origin at the center of the earth. The X_4 axis passes through the descending node of the orbit plane. The Z_4 axis lies in the desired orbit plane 90° downrange from the X_4 axis. The Y_4 axis completes a right handed system and is perpendicular to the orbit plane.

MISSION DESCRIPTION

The Apollo Soyuz Test Project (ASTP) results from a joint US/USSR Agreement made May 24, 1972, for cooperation in the peaceful exploration and utilization of space. The ASTP involves the rendezvous and docking of an Apollo type spacecraft with a Soyuz type spacecraft while in earth orbit. Its primary objective is to test the technical requirements and the solutions for a compatible rendezvous and docking system for future manned spacecraft. This will lend experience in conducting joint flights by US and USSR spacecraft, including, in case of necessity, rendering aid in emergency situations.

The nominal mission sequence begins with the launch of the Soyuz spacecraft (2 cosmonauts) into a 125 NM circular orbit with an inclination of 51.6° to the equator. The Apollo spacecraft (3 astronauts) follows about 7.5 hours later into a low earth orbit, 81 x 90 NM, at an inclination of 51.6°.

After orbit insertion, the Apollo spacecraft will separate, turn around to extract the docking module from the SLA, and begin a series of maneuvers to rendezvous and dock with the Soyuz. Docked duration for the nominal mission is planned for approximately two days. During this time the astronauts and cosmonauts will perform joint activities, including exchange of crewmen to both spacecraft.

After final separation, the two spacecraft will continue in orbit for approximately one to two more days to conduct various other experiments. The planned mission duration for the Apollo spacecraft is 5 days plus 3 hours; for the Soyuz, 4 days plus 2.5 hours. The prime recovery area for Apollo is in the Pacific near Hawaii; for the Soyuz, Kazaphstan.

TRAJECTORY DESCRIPTION

Three trajectory simulations are documented in this report: a typical launch window opening, a typical planar case, and a typical launch window closing case. The distinguishing characteristics and the target conditions are tabulated below.

<u>Trajectory</u>	<u>Launch Azimuth (deg)</u>	<u>Target Node (deg)</u>	<u>Inclination (deg)</u>	<u>Orbit (NM)</u>
Typical Launch Window Opening	50.690	158.115	51.575	81 x 91
Typical Planar Case	42.900	156.015	51.575	81 x 100
Typical Launch Window Closing	36.144	154.188	51.575	81 x 90

Subsequent to the generation of these trajectories, the decision was made to target the vehicle for an 81 x 90 nautical mile orbit for all launch opportunities. This would increase the performance margins on the opening and planar cases by approximately 10 and 100 pounds, respectively.

These trajectories were simulated using the 209 mass and propulsion data which were generated for a winter launch. Since ASTP is scheduled for a summer launch, the performance will be slightly higher than is shown in this report.

Figures 1A, 1C, and 1E depict the contrast in the inertial yaw attitude and yaw attitude command for the typical launch window opening, typical planar case, and typical launch window closing, respectively. Figures 2C through 16C are shown for the planar case only, but are representative for the opening and closing cases.

REFERENCES

1. "SA-209 Launch Vehicle Preoperational Flight Trajectory," S&E-AERO-MFP-47-72, April 7, 1972.
2. Apollo/Soyuz Test Project, Launch Window Plan, ASTP40100, October 19, 1972.
3. Apollo Soyuz Test Project Targets; Telecon -- Ken Young to James L. Crafts, September 15, 1972.
4. ASTP Mission Summary, Presentation by R. E. Beaman, August 1972.
5. Apollo Launch Opportunities for the Apollo Soyuz Test Project Mission; Telecon -- Bob Merriam to Joe Brooks, March 29, 1973.

APPENDIX A

**TRAJECTORY LISTING FOR A
TYPICAL LAUNCH WINDOW OPENING
METRIC UNITS**

TABLE 1A

**APOLLO SOYUZ TEST PROJECT
S-IB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW OPENING**

Flight Time: OECO + 1.379 seconds	143.00	(sec)
Radius:	6 432203.	(m)
Altitude:	59035.	(m)
Space Fixed Velocity:	2339.38	(m/s)
Space Fixed Path Angle:	66.360	(deg)
Space Fixed Flight Azimuth:	57.939	(deg)
Earth Fixed Flight Azimuth:	51.011	(deg)
Geocentric Declination:	28.849	(deg)
Geodetic Latitude:	29.012	(deg)
Longitude:(Pos. East)	-80.081	(deg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	6431054.	(m)
Ys =	55619.	(m)
Zs =	108097.	(m)
Xs =	899.97	(m/s)
Ys =	256.78	(m/s)
Zs =	2144.02	(m/s)

VEHICLE ATTITUDE AND ATTITUDE RATE

Pitch Attitude Angle:	-63.758	(deg)
Yaw Attitude Angle:	-0.065	(deg)
Roll Attitude Angle:	0.005	(deg)
Pitch Rate:	-0.010	(deg/s)
Yaw Rate	0.015	(deg/s)
Roll Rate:	0.004	(deg/s)

TABLE 2A

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW OPENING

Flight Time: Guidance Cutoff Signal	591.11	(sec)
Radius:	6528187.	(m)
Altitude:	158413.	(m)
Space Fixed Velocity:	7812.37	(m/s)
Space Fixed Flight Path Angle:	90.009	(deg)
Space Fixed Flight Azimuth:	52.810	(deg)
Earth Fixed Flight Azimuth:	51.099	(deg)
Geocentric Declination:	38.720	(deg)
Geodetic Latitude:	38.908	(deg)
Longitude: (Pos. East)	-65.553	(deg)
Inclination:	51.571	(deg)
Descending Node Argument:	158.108	(deg)
Inertial Range Angle:	17.845	(deg)
Mass:	30589.	(kg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

X _s =	62176.59	(m)
Y _s =	2548.	(m)
Z _s =	1989456.	(m)
X _s =	-2359.94	(m/s)
Y _s =	-1052.02	(m/s)
Z _s =	7372.72	(m/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-99.637	(deg)
Yaw Attitude Angle	=	-17.247	(deg)
Roll Attitude Angle	=	-0.712	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	144.18	(km)
*Apogee Altitude	=	150.36	(km)
Eccentricity	=	.00047	
Semi-Major Axis	=	6525.44	(km)
True Anomaly	=	200.333	(deg)
Period	=	87.43	(min)

* Referenced to Equatorial Radius (6378.16 km)

TABLE 2A (CONTINUED)

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW OPENING

Flight Time: Orbit Insertion	601.11	(sec)
Radius:	6528184.	(m)
Altitude:	158562.	(m)
Space Fixed Velocity:	7819.66	(m/s)
Space Fixed Flight Path Angle:	90.001	(deg)
Space Fixed Flight Azimuth:	53.244	(deg)
Earth Fixed Flight Azimuth:	51.562	(deg)
Geocentric Declination:	39.133	(deg)
Geodetic Latitude:	39.321	(deg)
Longitude: (Pos. East)	-64.890	(deg)
Inclination:	51.576	(deg)
Descending Node Argument:	158.117	(deg)
Inertial Range Angle:	18.526	(deg)
Mass:	30514.	(kg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	6193603.	(m)
Ys =	-7994.	(m)
Zs =	2063107.	(m)
Xs =	-2450.02	(m/s)
Ys =	-1054.14	(m/s)
Zs =	7350.73	(m/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle =	-99.635	(deg)
Yaw Attitude Angle =	-17.257	(deg)
Roll Attitude Angle =	-0.764	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	149.96	(km)
*Apogee Altitude	=	169.01	(km)
Eccentricity	=	.00145	
Semi-Major Axis	=	6537.63	(km)
True Anomaly	=	359.73	(deg)
Period	=	87.68	(min)

* Referenced to Equatorial Radius (6378.16 km)

TABLE 3A
APOLLO SOYUZ TEST PROJECT
SEQUENCE OF EVENTS
TYPICAL LAUNCH WINDOW OPENING

FLIGHT TIME (SEC)	PROGRAM TIME (SEC)	
-17.20	---	Guidance Reference Release (GRR)
0.00	---	First Motion
0.20	(0.00) ₁	Lift-off Signal; Initiate Time Base One
59.77	---	Mach One
74.40	---	Maximum Dynamic Pressure
132.00	(131.80) ₁	Tilt Arrest
135.62	(0.00) ₂	Level Sensor Activation; Initiate Time Base Two
138.62	(3.00) ₂	Inboard Engine Cutoff (IECO)
141.62	(0.00) ₃	Outboard Engine Cutoff (OECO); Initiate Time Base Three
142.72	(1.10) ₃	Ignite Ullage Rockets
142.92	(1.30) ₃	Separation Signal
143.00	---	S-IB/S-IVB Physical Separation
144.32	(2.70) ₃	S-IVB J-2 Engine Start Command
147.72	---	90 Percent J-2 Thrust Level
150.72	---	Termination of Ullage Burn
154.92	(13.30) ₃	Jettison Ullage Rockets
166.14	---	Dynamic Pressure = 1 PSF
*166.62	---	LES Jettison
*171.75	(30.00) ₃	IGM Initiation
469.72	(328.10) ₃	EMR Shift Command
591.11	---	Guidance Cutoff Signal (GCS)
591.31	(0.00) ₄	Inertial Attitude Freeze, Initiate Time Base Four
601.11	---	Orbit Insertion (OI)

*

LES Jettison was simulated at $TB_3 + 25$ sec, IGM Initiation 5 sec later. In future documents, these values will be 5 sec later to account for dispersions in time at which dynamic pressure reaches 1 PSF. The same note applies to tables 3B, 3C, 3D, 3E and 3F.

TABLE 4A
APOLLO 5022 TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-IB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC ²)	DYNAMIC PRESSURE (N/M ²)	A.H.I. (KG-M/M ² -RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1) -17.20	594674.	0.	0.	0.00	0.	0.	0.00	N/A
2) -0.00	588243.	7132169.	262.	12.145	1.	0.	0.00	N/A
10.00	559814.	7344526.	11424.	13.120	516.	2383.	0.09	-1.764
20.00	531215.	7457508.	44616.	13.976	2498.	49161.	0.20	-1.383
30.00	502471.	7561067.	94518.	14.878	6569.	314724.	0.33	-0.535
40.00	473691.	7664447.	153880.	15.967	12875.	1220305.	0.51	0.074
50.00	444882.	7821160.	238925.	17.059	24760.	3497888.	0.73	0.246
60.00	416079.	7948216.	655866.	17.506	28144.	8072623.	1.00	0.137
70.00	387128.	8082199.	655174.	19.196	32415.	8209263.	1.01	0.133
74.40	374369.	8134364.	570163.	20.214	32982.	19678014.	1.56	-0.183
83.00	358161.	8187051.	479204.	21.524	31962.	25596387.	1.85	-0.008
90.00	329300.	8244743.	314470.	24.082	24278.	36911163.	2.40	-0.217
100.00	300560.	8261614.	173280.	25.911	15237.	46858750.	2.94	-0.520
110.00	271886.	8249365.	87356.	30.022	6526.	54296917.	3.55	-1.346
120.00	243314.	8215096.	24469.	33.666	4353.	59262350.	4.22	-2.154
130.00	214692.	8161850.	-4742.	38.008	2143.	62329862.	5.01	-3.103
5) 132.00	2069239.	8147198.	-7700.	38.979	1862.	62782598.	5.20	-3.285
6) 135.62	199862.	8116484.	-13938.	40.058	1460.	63499178.	5.64	-2.564
7) 138.62	194566.	8076495.	-21481.	42.567	1176.	64016431.	6.04	-1.677
140.00	188213.	4128250.	-21185.	42.647	1035.	64214684.	6.17	-1.337
8) 141.62	185432.	3572513.	-22608.	17.385	886.	64479266.	6.32	-0.848
9) 142.72	184799.	297075.	-20342.	1.447	762.	64628687.	6.36	-0.576
10) 142.92	184684.	295064.	-19927.	1.492	764.	64649096.	6.36	-0.532
11) 143.00	184671.	242846.	-19767.	1.422	757.	64656622.	6.36	-0.517

- 1) Guidance Reference Release
- 2) First Motion
- 3) Mach One
- 4) Maximum Dynamic Pressure
- 5) Tilt Arrest
- 6) LSA, Initiate Time Base Two
- 7) IECO
- 8) OECO, Initiate Time Base Three
- 9) Ignite Ullage Rockets
- 10) Separation Signal
- 11) S-IB/S-IVB Physical Separation

TABLE 5A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-18 STAGE FLIGHT DATA

FLIGHT TIME (SEC)	---- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
10	-17.00	6373379.	408.57	90.000	6373353.	13962.	-11383.	0.00	258.83	316.12
	0.00	6373379.	408.57	96.360	6373349.	18352.	-5944.	-0.45	258.04	316.28
	10.00	6373520.	409.52	65.853	6373485.	20936.	-2781.	28.91	258.43	316.36
	20.00	6373996.	416.54	80.739	6373952.	23521.	-393.	66.06	258.28	320.05
	30.00	6374887.	436.77	75.062	6374833.	26103.	3655.	111.34	258.19	334.23
	40.00	6376275.	473.57	69.449	6376266.	28687.	7119.	164.68	258.83	360.76
	50.00	6378238.	530.08	64.558	6378152.	31283.	16922.	225.75	280.28	402.83
	59.77	6380780.	604.61	61.084	6380672.	33832.	15131.	289.86	261.43	461.71
	60.00	6380847.	616.52	61.026	6380739.	33892.	15238.	291.32	261.46	463.30
	70.00	6384119.	741.10	59.120	6383973.	36515.	20250.	350.61	263.27	543.20
	74.46	6385764.	751.73	58.578	6385613.	37676.	22737.	388.27	263.85	587.13
	80.00	6388077.	824.60	58.155	6387933.	39154.	26198.	430.79	264.45	651.49
	90.00	6392831.	979.70	58.417	6392666.	41796.	33393.	510.27	263.64	793.93
	100.00	6398414.	1170.18	59.200	6390111.	44427.	42216.	590.95	262.69	975.24
	110.00	6404828.	1396.01	63.582	6404434.	47051.	53025.	673.92	261.96	1194.18
	120.00	6412124.	1460.83	62.236	6411589.	49666.	66236.	750.07	260.95	1455.24
	130.00	6420352.	1770.21	64.062	6417562.	52267.	82294.	837.14	269.24	1764.57
	132.00	6422043.	2038.05	64.440	6421252.	52785.	85892.	852.79	258.82	1832.87
	135.62	6425289.	2166.53	65.113	6424395.	53722.	92769.	881.38	258.01	1862.26
	138.62	6428069.	2478.50	65.595	6427378.	54495.	98824.	907.51	257.31	2074.07
	140.00	6429368.	2519.46	65.825	6428329.	54849.	101701.	910.38	257.07	2106.76
	141.62	6430936.	2337.65	66.103	6429849.	55266.	105151.	910.09	256.88	2137.84
	142.72	6431945.	2340.03	66.306	6430866.	55549.	107507.	902.44	256.80	2143.69
	142.92	6432133.	2337.56	66.345	6430987.	55606.	107936.	900.65	256.78	2143.93
	143.00	6432203.	2339.38	66.360	6431054.	55619.	108397.	899.97	256.76	2144.02

TABLE 6A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
-17.2	9.0	0.0	N/A	9.0	0.0	0.0	0.0	0.0	0.0
0.0	9.0	0.0	N/A	9.0	0.0	0.0	0.0	0.0	0.0
13.00	231.	27.02	43.6	231.	-1.	-6.	29.02	-0.14	-0.05
23.00	7.7.	67.13	3.63	7.7.	-3.	9.	67.04	-0.27	3.44
33.00	16.2.	113.95	8.81	16.2.	-6.	103.	112.02	-0.37	17.34
43.00	30.13	171.91	14.759	28.7.	-8.	376.	166.32	-0.6	43.51
53.00	6.56	243.23	26.575	47.2.	2.	1025.	221.05	1.61	85.10
59.07	77.91	320.82	26.201	74.9.	23.	2127.	292.54	2.71	143.41
69.00	78.65	321.83	26.333	75.62.	24.	2151.	294.52	2.73	144.98
79.00	11537.	424.20	31.976	16426.	59.	3946.	364.09	4.52	224.20
79.40	13472.	474.89	34.386	12482.	81.	5007.	492.15	5.12	267.78
80.00	16280.	547.28	37.348	14796.	111.	6740.	435.30	5.76	331.66
90.00	22305.	7.01	42.516	19552.	167.	10752.	510.16	5.13	473.12
100.00	29968.	880.10	47.456	25124.	215.	16336.	590.66	4.57	653.35
110.00	39586.	1167.51	51.748	31536.	200.	23926.	683.98	4.48	871.05
120.00	51527.	1347.86	55.556	38045.	355.	33699.	769.68	4.45	1130.75
130.00	66228.	1672.94	58.994	46925.	348.	46745.	853.87	4.16	1438.62
132.00	69513.	1739.95	59.644	48050.	356.	49650.	870.36	4.08	1506.61
135.02	75845.	1867.01	63.768	51059.	371.	55344.	900.57	3.95	1635.44
138.02	81436.	1974.62	61.579	54062.	382.	60417.	920.14	3.86	1746.75
140.00	84696.	2064.36	61.907	55082.	348.	62045.	931.53	3.86	1779.28
141.02	87268.	2035.95	62.278	57397.	374.	65762.	931.01	3.94	1810.19
142.02	89465.	2037.75	62.519	58416.	398.	67758.	921.44	4.01	1815.99
142.92	89861.	2037.17	62.563	58603.	399.	68121.	922.69	4.02	1816.23
143.00	90059.	2036.95	62.579	58612.	400.	68257.	922.63	4.02	1816.31

TABLE 7A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY SPACE FIXED (DEG)	VECTOR AZIMUTH EARTH FIXED (DEG)	LONGITUDE (FUS, EAST)	GEOCENTRIC DECLINATION (DEG)	GEOETIC LATITUDE (DEG)
-17.28	0.305	0.400	0.00	90.000	N/A	-86.621	28.466	28.627
0.00	0.090	0.000	1.19	90.000	N/A	-86.621	28.466	28.627
10.00	0.231	0.001	29.65	59.978	39.397	-86.621	28.466	28.627
20.00	0.707	0.011	67.11	09.641	44.085	-86.621	28.466	28.627
30.00	1.599	0.107	113.57	88.427	48.691	-86.620	28.466	28.628
40.00	2.787	0.402	170.44	06.462	50.554	-86.618	28.468	28.630
50.00	4.952	1.033	239.44	03.609	51.438	-86.613	28.472	28.633
59.77	7.195	2.138	318.36	00.203	51.521	-86.604	28.478	28.639
60.00	7.563	2.172	320.26	00.101	51.521	-86.604	28.478	28.640
70.00	1.0428	3.999	41.54	76.669	51.658	-86.589	28.488	28.650
74.40	12.485	5.034	459.10	74.935	51.620	-86.580	28.494	28.656
80.00	14.000	6.751	531.86	72.657	51.645	-86.567	28.504	28.665
90.00	19.562	10.735	694.03	09.154	51.215	-86.535	28.526	28.688
110.00	25.195	16.317	877.14	03.673	51.037	-86.491	28.558	28.719
115.00	31.582	23.004	1089.06	03.025	51.077	-86.431	28.600	28.762
120.00	36.895	33.063	1543.02	01.057	50.958	-86.352	28.656	28.819
130.00	47.096	40.447	1656.09	57.030	50.958	-86.251	28.728	28.891
132.00	48.842	49.360	1719.24	57.046	50.960	-86.228	28.745	28.907
135.02	52.098	54.989	1647.59	58.530	50.969	-86.163	28.776	28.939
138.62	57.687	64.000	1756.58	58.130	50.978	-86.143	28.805	28.968
140.00	56.190	62.376	1983.20	58.030	50.946	-86.124	28.818	28.981
141.02	57.734	65.275	2016.18	57.917	56.999	-86.101	28.835	28.998
142.72	58.776	67.244	2018.59	57.938	51.059	-86.085	28.846	29.009
142.92	58.969	67.603	2017.36	57.939	51.011	-86.062	28.846	29.011
143.00	59.535	67.737	2017.00	57.939	51.011	-86.001	28.849	29.012

TABLE 8A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
-17.20	.000	.000	-39.310	-.003	.002	.002	.000	.000	.000
.00	-.049	.040	-39.276	-.003	.002	.002	-.049	.040	.034
10.00	-.022	-.010	-39.310	-.001	.001	.000	-.011	-.022	.000
20.00	-3.512	-.004	-30.742	-.407	-.000	1.004	.283	.161	-.932
30.00	-7.733	.013	-20.740	-.441	.005	1.000	.341	.143	-.930
40.00	-12.385	.021	-10.741	-.496	-.006	1.000	.439	.100	-.931
50.00	-17.770	.030	-.757	-.549	-.024	.926	.455	.155	-.654
59.77	-23.227	.058	-.003	-.556	-.012	.061	.397	.508	-.005
68.00	-23.355	.511	-.003	-.555	-.014	.001	.399	.511	-.004
70.00	-29.062	.650	.005	-.591	-.043	-.001	.535	.650	.002
74.40	-31.714	.671	.010	-.601	.025	.061	.619	.671	.006
80.00	-35.323	.526	.004	-.678	.026	-.062	.671	.520	.001
90.00	-42.545	.885	.002	-.770	.036	.003	.661	.085	.001
100.00	-47.936	.012	.009	-.501	-.003	.001	.436	.012	.009
110.00	-52.819	.046	.017	-.495	.002	.000	.439	.046	.017
120.00	-57.566	.066	.014	-.469	-.002	.000	.444	.069	.013
130.00	-62.348	.164	.010	-.469	-.002	-.000	.405	.164	.009
132.00	-63.287	.169	.009	-.470	-.002	-.000	.425	.169	.008
135.62	-63.819	.172	.007	-.656	-.001	-.003	.107	.172	.007
138.62	-63.792	.172	.005	-.613	.001	.000	.079	.172	.005
140.00	-63.789	.128	.004	.615	.054	-.001	.077	.128	.004
141.62	-63.762	.077	.003	.615	.009	-.001	.050	.077	.003
142.72	-63.756	.069	.004	-.005	.012	.003	.043	.069	.004
142.92	-63.757	.066	.004	-.009	.014	.004	.045	.066	.004
143.00	-63.756	.065	.005	-.010	.015	.004	.046	.065	.005

TABLE 9A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	5-4B STAGE FLIGHT DATA		CENTRAL PRESSURE (N/M ²)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
				LONGITUDINAL ACCELERATION (M/S ²)	DYNAMIC PRESSURE (N/M ²)			
1)	143.00	139804.	40075.	3366.	.263	756.	1.0128	-63.712
2)	144.32	138834.	39965.	2632.	.268	645.	1.0153	-63.712
3)	147.72	138562.	854684.	1977.	5.794	424.	1.0216	-63.712
4)	150.72	137846.	866856.	1394.	6.279	361.	1.0272	-63.712
5)	154.92	136836.	161972.	661.	7.443	185.	1.0352	-63.712
	160.00	135533.	1619337.	497.	7.516	101.	1.0456	-63.712
6)	166.14	131167.	1619793.	256.	7.773	48.	1.051	-63.712
7)	166.62	136641.	1619713.	243.	7.664	45.	1.0560	-63.712
	170.00	128891.	1621336.	167.	7.923	30.	1.0647	-63.712
8)	171.75	128461.	1626161.	139.	7.987	24.	1.0683	-63.712
	180.00	126432.	1623228.	103.	8.093	8.	1.0851	-56.311
	190.00	123974.	1623368.	32.	8.255	2.	2.060	-57.281
	200.00	121518.	1623438.	11.	8.422	1.	2.275	-58.336
	210.00	119065.	1621221.	5.	8.577	0.	2.495	-59.220
	220.00	116614.	1620447.	2.	8.751	0.	2.722	-60.243
	230.00	114168.	1618423.	1.	8.920	0.	2.954	-61.104
	240.00	111721.	1617984.	1.	9.112	0.	3.193	-62.193
	250.00	109288.	1616538.	0.	9.304	0.	3.439	-63.063
	260.00	106838.	1616512.	0.	9.514	0.	3.691	-64.066
	270.00	104390.	1617894.	0.	9.751	0.	3.949	-65.299
	280.00	101944.	1616571.	0.	9.991	0.	4.215	-66.272
	290.00	99494.	1617727.	0.	10.229	0.	4.489	-67.375
	300.00	97046.	1616660.	0.	10.476	0.	4.770	-68.446
	310.00	94622.	1617254.	0.	10.753	0.	5.058	-69.365
	320.00	92159.	1616515.	0.	11.030	0.	5.355	-70.439
	330.00	89716.	1617338.	0.	11.339	0.	5.660	-71.432
	340.00	87266.	1618955.	0.	11.676	0.	5.974	-72.729
	350.00	84817.	1617470.	0.	11.990	0.	6.297	-73.759
	360.00	82372.	1616661.	0.	12.342	0.	6.629	-74.721
	370.00	79927.	1615560.	0.	12.706	0.	6.971	-75.764
	380.00	77477.	1618962.	0.	13.152	0.	7.322	-76.913
	390.00	75029.	1613965.	0.	13.514	0.	7.685	-78.012
	400.00	72567.	1613822.	0.	13.567	0.	8.058	-78.960
	410.00	70144.	1613546.	0.	14.449	0.	8.442	-80.085
	420.00	67762.	1613361.	0.	14.507	0.	8.836	-81.204

- 1) S-IB/S-IVB Physical Separation
- 2) S-IVB Start Command
- 3) J-2 90 Percent Thrust
- 4) Termination of Ullage Burn
- 5) Jettison Ullage Rockets
- 6) Dynamic Pressure = 1 PSF
- 7) LES Jettison
- 8) IGM Initiation

TABLE 9A (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S ²)	DYNAMIC PRESSURE (N/M ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
430.00	65259.	1016529.	0.	15.577	0.	9.246	-82.317	17.086
440.00	62809.	1017444.	0.	16.199	0.	9.667	-83.527	16.421
450.00	60364.	1013580.	0.	16.791	0.	10.101	-84.589	15.864
460.00	57920.	1013339.	0.	17.495	0.	10.549	-85.702	15.311
470.00	55522.	1012726.	0.	18.246	0.	11.011	-86.836	14.751
9) 470.25	55466.	912754.	0.	16.450	0.	11.023	-86.864	14.737
480.00	53415.	858999.	0.	16.081	0.	11.488	-87.979	14.242
490.00	51360.	858864.	0.	16.722	0.	11.978	-89.013	13.787
500.00	49306.	858732.	0.	17.416	0.	12.401	-90.041	13.276
510.00	47252.	858559.	0.	18.169	0.	13.060	-91.146	12.678
520.00	45199.	858380.	0.	18.991	0.	13.534	-92.322	11.972
530.00	43145.	858179.	0.	19.890	0.	14.004	-93.491	11.273
540.00	41092.	857962.	0.	20.879	0.	14.651	-94.701	10.567
550.00	39032.	861375.	0.	22.081	0.	15.235	-96.047	9.798
560.00	36973.	858674.	0.	23.224	0.	15.638	-97.233	9.106
570.00	34919.	858237.	0.	24.577	0.	16.461	-99.596	7.845
580.00	32867.	857623.	0.	26.093	0.	17.105	-99.622	7.486
590.00	30816.	856714.	0.	27.800	0.	17.771	-99.499	8.099
10) 591.11	30589.	856568.	0.	28.034	0.	17.846	-99.499	8.143
600.00	30517.	0.	0.	-0.000	0.	18.451	-99.499	8.756
11) 601.11	30514.	0.	4.	-0.000	0.	18.526	-99.635	8.834

9) EMR Shift
 10) Guidance Cutoff Signal
 11) Orbit Insertion

TABLE 10A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH RINDUR OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RAUUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
143.00	6432210.	2339.37	66.361	6431061.	55624.	108111.	899.94	256.78	2144.02	
144.52	6433441.	2334.63	66.621	6432210.	55960.	110943.	887.36	256.69	2144.11	
147.72	6436541.	2326.70	67.289	6435244.	56032.	118236.	856.84	256.61	2148.13	
150.72	6439209.	2334.20	67.851	6437743.	57002.	124704.	836.01	256.91	2164.16	
154.92	6442856.	2349.01	68.007	6441198.	58081.	133849.	809.49	256.60	2191.00	
160.00	6447137.	2369.83	69.198	6445225.	59781.	145052.	777.81	255.89	2223.88	
166.14	6452133.	2395.70	70.550	6449855.	61556.	158829.	734.00	265.04	2264.30	
166.62	6452520.	2397.87	70.632	6450243.	61574.	159928.	736.03	254.97	2267.56	
170.00	6455174.	2413.39	71.193	6452695.	62533.	167620.	716.36	254.42	2290.54	
171.75	6456528.	2421.67	71.480	6453939.	62978.	171639.	705.81	254.12	2302.57	
180.00	6462769.	2461.43	72.730	6459502.	65067.	190860.	658.91	251.03	2358.26	
190.00	6469820.	2510.85	74.017	6465911.	67563.	214774.	600.76	247.40	2423.36	
200.00	6476536.	2563.01	75.258	6471735.	70012.	239341.	558.13	242.28	2490.39	
210.00	6482868.	2619.63	76.448	6477002.	72466.	264588.	507.23	236.41	2559.16	
220.00	6488618.	2678.90	77.581	6481860.	74730.	290531.	456.22	229.82	2629.75	
230.00	6494393.	2741.26	78.061	6486106.	77600.	317188.	404.89	222.46	2702.05	
240.00	6499641.	2816.86	79.683	6481970.	79184.	344578.	353.41	214.22	2776.27	
250.00	6504448.	2075.63	80.056	6493252.	81282.	372720.	301.46	205.12	2852.42	
260.00	6506942.	2447.59	81.573	6496055.	83283.	401633.	249.14	195.01	2930.56	
270.00	6513091.	3123.22	82.440	6496234.	85179.	431345.	196.38	183.94	3011.22	
280.00	6516900.	3112.19	83.259	6499931.	86959.	461655.	142.93	171.87	3094.13	
290.00	6520317.	3184.67	84.028	6501091.	88612.	493231.	80.94	158.69	3179.49	
300.00	6523530.	3270.72	84.749	6501708.	90129.	525463.	34.25	144.38	3267.35	
310.00	6526366.	3361.13	85.424	6501714.	91496.	558586.	-21.16	128.86	3357.59	
320.00	6528895.	3453.16	86.050	6501263.	92702.	592624.	-77.26	112.07	3450.48	
330.00	6531126.	3549.86	86.633	6502226.	93733.	627604.	-134.28	94.00	3546.01	
340.00	6533169.	3651.69	87.171	6498595.	94577.	663556.	-192.10	74.52	3644.87	
350.00	6534732.	3755.66	87.672	6496377.	95220.	700512.	-251.33	53.78	3746.85	
360.00	6536125.	3864.55	88.130	6493565.	95647.	738503.	-311.62	31.47	3851.84	
370.00	6537259.	3977.60	88.547	6490144.	95844.	77756.	-372.96	7.58	3960.07	
380.00	6538147.	4095.23	88.923	6486102.	95794.	817717.	-435.50	-17.96	4071.97	
390.00	6538622.	4217.65	89.264	6481428.	95480.	859013.	-499.71	-45.09	4187.71	
400.00	6539235.	4344.46	89.567	6470104.	94086.	901482.	-565.27	-74.06	4306.89	
410.00	6539465.	4476.46	89.031	6470110.	93792.	945165.	-632.33	-104.97	4430.27	
420.00	6539505.	4613.04	90.061	6465452.	92786.	990103.	-701.26	-137.84	4558.11	

TABLE 1GA (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
430.00	6539372.	4/57.04	90.257	6450087.	91228.	1036343.	-972.13	-172.83	4690.78
440.00	6539085.	49.67.00	90.418	6440042.	89315.	1083938.	-845.15	-210.15	4829.10
450.00	6538663.	5663.19	90.547	6439176.	87616.	1132942.	-920.58	-249.77	4972.52
460.00	6538127.	5226.27	90.641	6429583.	84311.	1183408.	-998.35	-292.03	5121.71
470.00	6537501.	5396.93	90.703	6419260.	81168.	1235398.	-1078.63	-337.07	5277.25
470.25	6537485.	54.61.16	90.705	6418930.	81083.	1236718.	-1080.89	-338.20	5281.09
480.00	6536779.	5548.83	90.645	6409910.	77594.	1288645.	-1163.56	-378.08	5412.27
490.00	6535949.	5706.56	90.880	6395920.	73598.	1343661.	-1250.99	-421.36	5551.79
500.00	6535037.	5871.06	90.722	6382962.	69157.	1399899.	-1341.02	-467.27	5696.73
510.00	6534070.	6042.83	90.933	6369090.	64242.	1457615.	-1434.02	-516.25	5847.47
520.00	6533078.	6222.56	90.917	6354271.	58622.	1516870.	-1530.50	-568.39	6004.56
530.00	6532090.	6410.93	90.672	6338467.	52663.	1577736.	-1630.82	-623.88	6168.56
540.00	6531137.	6018.79	90.000	6321640.	46332.	1640268.	-1735.43	-682.84	6340.20
550.00	6530256.	6017.96	90.700	6305742.	39193.	1704567.	-1845.05	-745.52	6521.09
560.00	6529482.	7.38.64	90.577	6284719.	31410.	1770722.	-1960.55	-811.82	6711.37
570.00	6528855.	7271.81	90.423	6264514.	22938.	1838828.	-2081.44	-863.37	6911.33
580.00	6528403.	7519.31	90.268	6243047.	13720.	1908984.	-2212.39	-960.89	7121.94
590.00	6528190.	7762.26	90.139	6222621.	3706.	1981316.	-2345.13	-1042.68	7346.88
591.11	6528187.	7812.37	90.009	6217659.	2548.	1989456.	-2359.94	-1052.02	7372.72
600.00	6528185.	7819.67	90.001	6196367.	-6828.	2054976.	-2440.21	-1054.17	7354.00
601.11	6528184.	7819.66	90.001	6193643.	-7994.	2063107.	-2450.02	-1054.14	7350.73

TABLE 11A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
18	143.00	90024.	62.586	58679.	400.	68270.	922.00	4.02	1816.32
	144.32	92634.	62.869	59689.	405.	70670.	909.69	4.10	1816.37
	147.72	99327.	63.619	62929.	419.	76848.	879.91	4.47	1820.31
	150.72	105233.	64.276	65538.	434.	82332.	854.84	5.21	1836.22
	154.92	113545.	65.171	69496.	457.	90100.	834.43	5.55	1862.89
	160.00	123668.	66.229	73254.	485.	99637.	804.11	5.65	1895.59
	166.14	136037.	67.477	78079.	521.	111398.	767.79	5.83	1935.81
	166.62	137326.	67.574	78456.	523.	112336.	764.96	5.84	1939.06
	170.00	143866.	68.211	80799.	543.	116926.	745.44	5.89	1961.95
	171.75	147464.	68.582	82295.	553.	122364.	735.39	5.91	1973.94
	180.00	164507.	70.070	88171.	600.	138881.	696.86	4.93	2029.43
	190.00	185568.	71.606	94644.	638.	159496.	643.58	2.58	2094.30
	200.00	207697.	73.083	101043.	649.	180774.	596.05	-0.51	2161.19
	210.00	229124.	74.495	106764.	626.	202728.	546.30	-4.20	2229.92
	220.00	251678.	75.836	112669.	564.	225379.	500.55	-8.46	2300.53
	230.00	274792.	77.106	116775.	455.	248745.	452.59	-13.34	2372.96
	240.00	298496.	78.379	121661.	294.	272844.	404.60	-18.95	2447.39
	250.00	322825.	79.445	124665.	14.	297699.	356.20	-25.26	2523.84
	260.00	347811.	80.513	128185.	-213.	323328.	307.67	-32.40	2602.38
	270.00	373491.	81.517	131116.	-577.	349756.	256.78	-40.34	2683.54
	280.00	399900.	82.461	133359.	-1623.	377607.	209.32	-74.10	2767.05
	290.00	427075.	83.343	135204.	-1502.	405105.	159.47	-58.79	2853.12
	300.00	455053.	84.166	136547.	-2242.	434078.	109.65	-69.41	2941.80
	310.00	483872.	84.931	137383.	-2953.	463950.	58.05	-81.05	3032.97
	320.00	513568.	85.639	137167.	-3820.	494747.	6.52	-93.76	3126.91
	330.00	544160.	86.295	137511.	-4832.	526497.	-45.78	-107.54	3223.62
	340.00	575749.	86.896	136790.	-5981.	559231.	-98.73	-122.51	3323.77
	350.00	608319.	87.453	135532.	-7285.	592983.	-154.91	-138.51	3427.20
	360.00	641731.	87.961	133299.	-8756.	627786.	-207.98	-155.85	3533.77
	370.00	676628.	88.420	131570.	-10467.	663670.	-263.93	-174.52	3643.73
	380.00	712454.	88.832	128447.	-12251.	700673.	-320.90	-194.59	3757.51
	390.00	744462.	89.214	124947.	-14303.	738834.	-379.34	-215.97	3875.30
	400.00	787694.	89.533	120657.	-16576.	778191.	-438.94	-238.93	3996.69
	410.00	827263.	89.819	116165.	-19066.	818783.	-499.84	-263.52	4122.46
	420.00	866641.	90.066	110055.	-21651.	860656.	-562.37	-289.77	4252.89

TABLE 11A (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----						
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
430.00	910266.	4444.23	90+275	1049120.	-24888.	903858.	-626.63	-317.82	4388.34	
440.00	951943.	4595.51	90+446	98317.	-28215.	948443.	-692.78	-347.84	4529.65	
450.00	999136.	4753.03	90+583	91649.	-31851.	994468.	-761.10	-379.80	4676.30	
460.00	1045911.	4917.48	90+682	83488.	-35818.	1041990.	-831.48	-414.02	4828.95	
470.00	1094341.	5089.50	90+746	74411.	-40139.	1091070.	-904.30	-450.60	4988.21	
470.25	1095574.	5093.77	90+747	74185.	-40252.	1092318.	-906.16	-451.51	4992.14	
480.00	1144371.	5242.58	90+852	64984.	-44807.	1141646.	-981.00	-483.18	5127.14	
490.00	1195925.	5401.50	90+929	54772.	-49809.	1193631.	-1061.37	-517.63	5270.84	
500.00	1249068.	5567.20	90+972	43749.	-55167.	1247082.	-1143.49	-554.31	5420.23	
510.00	1303871.	5746.19	90+983	31693.	-66905.	1302057.	-1228.32	-593.64	5575.72	
520.00	1360408.	5921.15	90+964	19173.	-67049.	1358619.	-1316.34	-635.65	5737.88	
530.00	1418762.	6110.77	90+915	5555.	-73627.	1416839.	-1407.88	-680.53	5907.30	
540.00	1479022.	6369.88	90+838	-8998.	-86669.	1476793.	-1503.40	-728.33	6084.73	
550.00	1541289.	6620.29	90+732	-24528.	-88205.	1538568.	-1603.54	-779.24	6271.82	
560.00	1605678.	6742.40	90+603	-41088.	-96264.	1602263.	-1709.15	-833.12	6468.75	
570.00	1672304.	6976.62	90+441	-58727.	-104884.	1667978.	-1819.77	-891.59	6675.84	
580.00	1741291.	7225.41	90+279	-77525.	-114115.	1735818.	-1940.03	-955.20	6894.23	
590.00	1812791.	7489.59	90+041	-97532.	-124000.	1805913.	-2061.51	-1022.36	7127.34	
591.11	1820860.	7519.84	90+010	-99619.	-125135.	1813811.	-2075.04	-1030.03	7154.10	
600.00	1885938.	7527.67	90+001	-118613.	-134280.	1877409.	-2150.11	-1024.46	7140.33	
601.11	1894030.	7527.05	90+001	-120796.	-135412.	1885304.	-2159.29	-1023.49	7137.68	

TABLE 12A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH HINDW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED	AZIMUTH (DEG)	EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEOETIC LATITUDE (DEG)
143.00	59.642	67.750	2616.97	57.939	51.011	-86.081	28.849	29.012	
144.32	60.278	70.116	2610.54	57.930	51.024	-86.062	28.862	29.025	
147.72	63.388	70.205	1983.45	57.972	51.061	-86.014	28.896	29.060	
150.72	66.065	81.607	1968.93	57.961	51.106	-79.970	28.927	29.090	
154.92	69.727	89.251	2062.25	57.914	51.146	-79.949	28.970	29.133	
160.00	74.024	98.628	2619.72	57.852	51.186	-79.834	29.023	29.187	
166.14	79.641	110.179	2642.70	57.700	51.236	-79.742	29.088	29.252	
166.62	79.429	111.161	2644.65	57.774	51.240	-79.734	29.093	29.257	
170.00	82.096	117.560	2658.72	57.732	51.206	-79.602	29.130	29.293	
171.75	83.455	120.937	2066.28	57.711	51.280	-79.655	29.149	29.313	
186.00	89.665	137.123	2103.14	57.593	51.315	-79.525	29.240	29.404	
190.00	90.612	157.298	2149.67	57.440	51.329	-79.363	29.353	29.518	
200.00	103.568	178.688	2206.42	57.279	51.331	-79.195	29.470	29.635	
210.00	109.937	197.516	2254.55	57.114	51.325	-79.022	29.590	29.756	
220.00	115.927	221.000	2312.51	56.948	51.314	-78.844	29.714	29.880	
230.00	121.543	244.036	2373.47	56.700	51.296	-78.660	29.842	30.008	
240.00	126.793	267.022	2438.19	56.609	51.272	-78.476	29.974	30.141	
250.00	131.685	292.004	2500.52	56.437	51.243	-78.274	30.110	30.277	
260.00	136.224	310.930	2577.92	56.262	51.217	-78.072	30.250	30.418	
270.00	140.426	342.626	2653.46	56.104	51.167	-77.864	30.395	30.563	
280.00	144.278	369.124	2732.43	55.967	51.124	-77.648	30.545	30.713	
290.00	147.806	396.740	2815.16	55.727	51.076	-77.426	30.699	30.868	
300.00	151.011	424.014	2901.59	55.548	51.024	-77.197	30.858	31.028	
310.00	153.901	453.671	2991.54	55.368	50.976	-76.960	31.023	31.193	
320.00	156.487	483.642	3085.25	55.187	50.912	-76.716	31.193	31.363	
330.00	158.770	514.557	3182.07	55.008	50.853	-76.463	31.368	31.539	
340.00	160.779	546.452	3284.45	54.829	50.793	-76.203	31.549	31.721	
350.00	162.505	579.365	3390.38	54.654	50.734	-75.933	31.736	31.909	
360.00	163.962	613.333	3500.33	54.400	50.674	-75.655	31.930	32.103	
370.00	165.163	646.393	3614.48	54.308	50.614	-75.367	32.130	32.303	
380.00	166.121	684.586	3733.29	54.139	50.555	-75.070	32.337	32.511	
390.00	166.849	721.957	3856.92	53.975	50.500	-74.762	32.550	32.725	
400.00	167.358	760.549	3984.98	53.615	50.446	-74.444	32.771	32.947	
410.00	167.665	800.410	4118.20	53.359	50.394	-74.115	33.000	33.176	
420.00	167.785	841.589	4250.92	53.099	50.346	-73.774	33.236	33.413	

TABLE 12A (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH GINDUW OPENING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
430.00	167.737	884.143	4461.50	53.364	50.303	-73.421	33.481	33.656
440.00	167.537	928.132	4552.80	53.225	50.264	-73.055	33.734	33.912
450.00	167.266	973.621	4710.35	53.094	50.231	-72.676	33.996	34.174
460.00	166.764	1020.673	4874.81	52.969	50.203	-72.263	34.267	34.446
470.00	166.236	1069.360	5046.84	52.852	50.182	-71.875	34.548	34.727
470.25	166.222	1070.599	5051.11	52.850	50.182	-71.864	34.555	34.735
480.00	165.615	1119.032	5199.88	52.797	50.211	-71.452	34.837	35.018
490.00	164.890	1171.419	5358.76	52.750	50.247	-71.014	35.136	35.317
500.00	164.086	1224.787	5524.46	52.711	50.289	-70.561	35.443	35.625
510.00	163.232	1279.845	5697.34	52.677	50.336	-70.092	35.759	35.942
520.00	162.355	1336.547	5878.23	52.651	50.390	-69.606	36.086	36.269
530.00	161.487	1395.695	6067.77	52.634	50.452	-69.102	36.422	36.606
540.00	160.658	1455.537	6266.80	52.628	50.524	-68.579	36.768	36.953
550.00	159.906	1517.974	6477.12	52.635	50.610	-68.035	37.126	37.311
560.00	159.264	1582.518	6699.11	52.660	50.712	-67.469	37.494	37.680
570.00	158.775	1649.282	6933.21	52.693	50.822	-66.880	37.875	38.062
580.00	158.465	1718.393	7181.86	52.734	50.939	-66.266	38.268	38.455
590.00	158.400	1789.994	7445.89	52.801	51.082	-65.625	38.674	38.862
591.11	158.413	1798.573	7476.12	52.810	51.099	-65.553	38.720	38.908
600.00	158.546	1863.235	7482.93	53.195	51.509	-64.963	39.088	39.276
601.11	158.562	1971.438	7482.86	53.244	51.502	-64.896	39.133	39.321

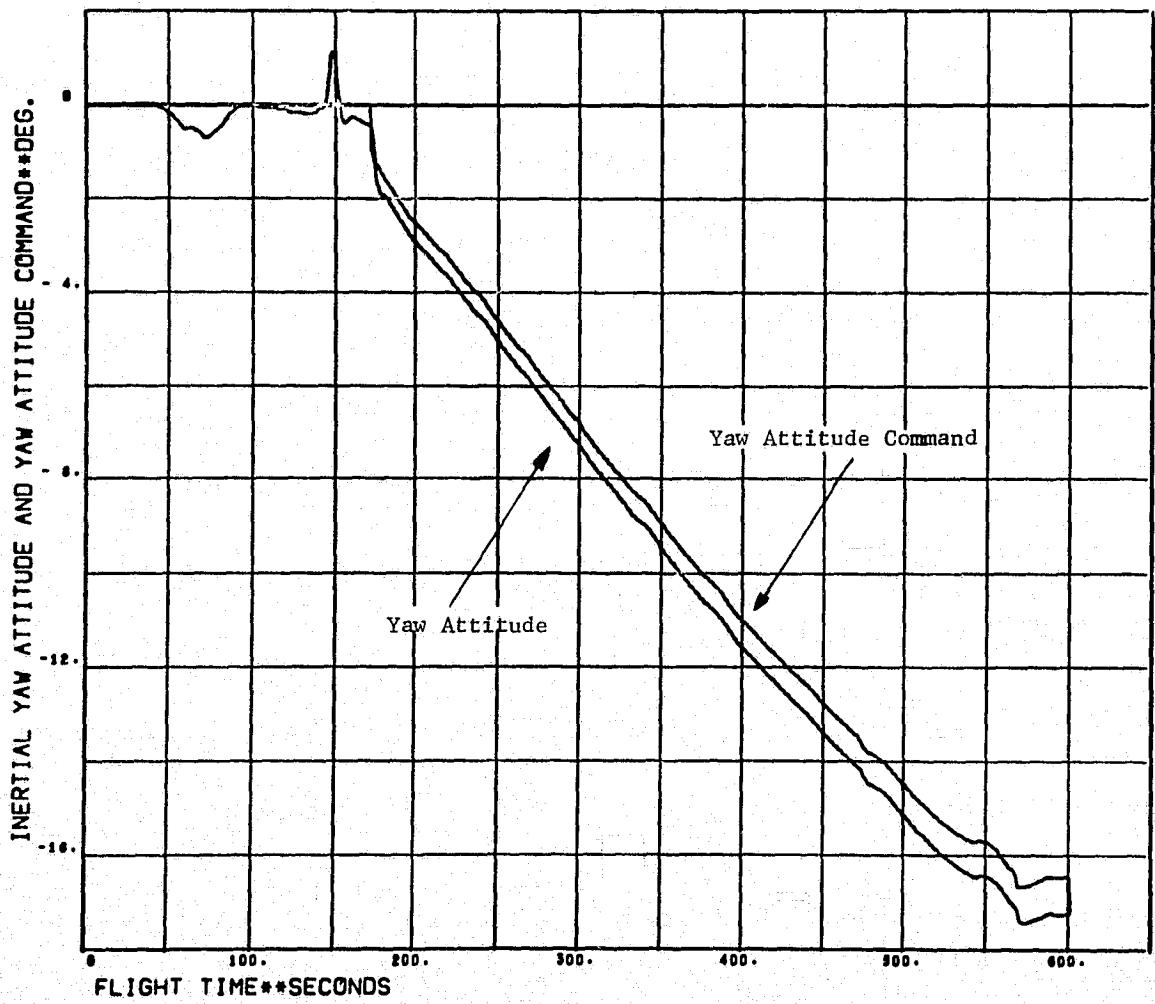
TABLE 13A
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
143.00	-63.756	-0.005	0.005	-0.016	0.015	0.004	-0.046	-0.005	0.005
144.32	-63.824	0.225	0.019	-0.002	0.134	0.017	-0.112	0.025	0.019
147.72	-64.184	1.025	0.138	-0.040	0.255	0.086	-0.471	1.025	0.135
150.72	-63.807	0.751	0.158	-0.175	-0.315	-0.098	-0.173	0.752	0.157
154.92	-63.466	-0.330	-0.288	0.000	-0.088	-0.104	0.247	0.330	-0.289
160.00	-63.556	-0.277	-0.291	-0.017	0.018	-0.026	0.127	-0.277	-0.291
166.14	-63.630	-0.348	-0.302	-0.005	-0.021	0.087	0.075	0.348	-0.302
166.62	-63.641	-0.358	-0.262	-0.005	-0.020	0.078	0.072	0.358	-0.262
174.00	-63.662	-0.413	-0.105	-0.009	-0.009	0.017	0.051	0.413	-0.106
171.75	-63.678	-0.423	-0.096	-0.010	-0.013	-0.008	0.034	0.423	-0.098
180.00	-56.982	-1.925	0.552	0.088	-0.007	0.018	-0.672	-0.416	0.572
190.00	-57.241	-2.345	-0.391	-0.067	-0.054	-0.068	0.041	-0.370	-0.392
200.00	-58.228	-2.983	-0.311	-0.130	-0.041	0.039	0.109	-0.392	-0.316
216.00	-59.161	-3.288	0.133	-0.087	-0.040	0.043	0.058	0.403	0.130
220.00	-60.199	-3.656	0.490	-0.095	-0.041	0.037	0.041	0.402	0.487
230.00	-61.013	-4.121	0.693	-0.089	-0.046	-0.049	0.058	-0.412	0.689
240.00	-62.034	-4.538	0.144	-0.133	-0.034	-0.065	0.047	-0.429	0.137
250.00	-63.059	-5.017	-0.368	-0.089	-0.049	-0.051	0.055	-0.420	0.372
260.00	-63.974	-5.483	-0.685	-0.105	-0.044	0.031	0.074	-0.434	0.692
270.00	-65.255	-5.858	-0.448	-0.163	-0.046	0.031	0.046	-0.430	0.452
280.00	-66.201	-6.350	-0.106	-0.101	-0.047	0.031	0.072	-0.448	0.113
290.00	-67.304	-6.785	0.169	-0.168	-0.044	0.028	0.070	-0.455	0.161
300.00	-68.377	-7.231	0.447	-0.111	-0.044	0.026	0.060	-0.460	0.439
310.00	-69.293	-7.737	0.719	-0.103	-0.045	0.028	0.072	-0.476	0.770
320.00	-70.371	-8.171	0.328	-0.106	-0.045	-0.054	0.066	-0.480	0.318
330.00	-71.383	-8.632	-0.197	-0.095	-0.048	-0.050	0.049	-0.484	-0.204
340.00	-72.624	-8.992	-0.729	-0.143	-0.029	0.013	0.107	-0.510	-0.745
350.00	-73.742	-9.412	-0.465	-0.109	-0.054	0.027	0.019	-0.514	-0.468
360.00	-74.731	-9.906	-0.141	-0.102	-0.044	0.029	0.020	-0.531	-0.145
370.00	-75.740	-10.329	0.138	-0.105	-0.042	0.027	0.023	-0.541	0.134
380.00	-76.853	-10.715	0.375	-0.134	-0.029	0.013	0.056	-0.566	0.365
390.00	-78.016	-11.074	0.584	-0.080	-0.051	0.034	-0.086	-0.548	0.584
400.00	-78.929	-11.565	0.507	-0.110	-0.038	-0.054	0.028	-0.576	0.501
410.00	-80.058	-11.933	-0.050	-0.114	-0.037	-0.056	0.026	-0.583	-0.056
420.00	-81.184	-12.364	-0.614	-0.112	-0.037	-0.056	0.023	-0.591	-0.618

TABLE 13A (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-48 STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
430.00	-82.297	-12.674	-0.563	-0.111	-0.037	-0.052	-0.023	-0.602	-0.567
440.00	-83.505	-12.995	-0.098	-0.115	-0.035	-0.049	-0.022	-0.612	-0.103
450.00	-84.575	-13.384	-0.431	-0.105	-0.039	-0.053	-0.012	-0.619	-0.427
460.00	-85.681	-13.740	-0.357	-0.113	-0.034	-0.046	-0.018	-0.633	-0.352
470.00	-86.820	-14.076	-0.113	-0.114	-0.033	-0.047	-0.016	-0.641	-0.117
470.25	-86.846	-14.085	-0.125	-0.114	-0.034	-0.047	-0.017	-0.641	-0.128
480.00	-87.974	-14.514	-0.595	-0.108	-0.020	-0.046	-0.008	-0.670	-0.596
490.00	-89.022	-14.750	-0.816	-0.099	-0.035	-0.043	-0.004	-0.651	-0.814
500.00	-90.037	-15.148	-0.406	-0.108	-0.040	-0.037	-0.006	-0.658	-0.407
510.00	-91.125	-15.550	-0.042	-0.115	-0.026	-0.032	-0.021	-0.684	-0.048
520.00	-92.310	-15.873	-0.258	-0.114	-0.033	-0.032	-0.009	-0.684	-0.255
530.00	-93.473	-16.166	-0.559	-0.119	-0.026	-0.028	-0.015	-0.700	-0.554
540.00	-94.682	-16.395	-0.473	-0.122	-0.021	-0.059	-0.015	-0.712	-0.468
550.00	-96.014	-16.452	-0.179	-0.143	-0.008	-0.071	-0.033	-0.731	-0.189
560.00	-97.263	-16.731	-0.788	-0.102	-0.064	-0.048	-0.025	-0.672	-0.779
570.00	-99.028	-17.323	-0.950	-0.680	-0.130	-0.125	-0.548	-0.645	-1.115
580.00	-99.774	-17.380	-0.248	-0.015	-0.011	-0.067	-0.144	-0.780	-0.204
590.00	-99.636	-17.246	-0.707	-0.000	-0.001	-0.005	-0.127	-0.772	-0.667
591.11	-99.637	-17.247	-0.712	-0.000	-0.001	-0.005	-0.127	-0.773	-0.672
600.00	-99.635	-17.256	-0.759	-0.001	-0.001	-0.005	-0.126	-0.781	-0.719
601.11	-99.635	-17.257	-0.764	-0.001	-0.005	-0.012	-0.125	-0.783	-0.725

FIGURE 1A
APOLLO/SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
INERTIAL YAW ATTITUDE AND YAW ATTITUDE COMMAND HISTORIES



TIME .VS. CHIZ , THZ

APPENDIX B

**TRAJECTORY LISTING FOR A
TYPICAL LAUNCH WINDOW OPENING
ENGLISH UNITS**

TABLE 1B

APOLLO SOYUZ TEST PROJECT
S-IB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW OPENING

Flight Time: OECO + 1.379 seconds	143.00	(sec)
Radius:	21103029.	(ft)
Altitude:	193685.	(ft)
Space Fixed Velocity:	7675.13	(m/s)
Space Fixed Path Angle:	66.360	(deg)
Space Fixed Flight Azimuth:	57.939	(deg)
Earth Fixed Flight Azimuth:	51.011	(deg)
Geocentric Declination:	28.849	(deg)
Geodetic Latitude:	29.012	(deg)
Longitude: (Pos. East)	-80.081	(deg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	21099259.	(ft)
Ys =	182478.	(ft)
Zs =	354648.	(ft)
\dot{X}_s =	2952.67	(ft/s)
\dot{Y}_s =	842.45	(ft/s)
\dot{Z}_s =	7034.18	(ft/s)

VEHICLE ATTITUDE AND ATTITUDE RATE

Pitch Attitude Angle	=	-63.758	(deg)
Yaw Attitude Angle	=	-0.065	(deg)
Roll Attitude Angle	=	0.005	(deg)
Pitch Rate	=	-0.010	(deg/s)
Yaw Rate	=	0.015	(deg/s)
Roll Rate	=	0.004	(deg/s)

TABLE 2B

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW OPENING

Flight Time: Guidance Cutoff Signal	591.11	(sec)
Radius:	21417935.	(ft)
Altitude:	519729.	(ft)
Space Fixed Velocity:	25631.12	(ft/s)
Space Fixed Flight Path Angle:	90.009	(deg)
Space Fixed Flight Azimuth:	52.810	(deg)
Earth Fixed Flight Azimuth:	51.099	(deg)
Geocentric Declination:	38.720	(deg)
Geodetic Latitude:	38.908	(deg)
Longitude: (Pos. East)	-65.553	(deg)
Inclination:	51.571	(deg)
Descending Node Argument:	158.108	(deg)
Inertial Range Angle:	17.845	(deg)
Weight:	67438.	(lbs)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	20399142.	(ft)
Ys =	8358.	(ft)
Zs =	6527086.	(ft)
\dot{X}_s =	-7742.59	(ft/s)
\dot{Y}_s =	-3451.51	(ft/s)
\dot{Z}_s =	24188.71	(ft/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle =	-99.637	(deg)
Yaw Attitude Angle =	-17.247	(deg)
Roll Attitude Angle =	-0.712	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude =	473031.50	(ft)
*Apogee Altitude =	493307.09	(ft)
Eccentricity =	.00047	
Semi-Major Axis =	21408923.92	(ft)
True Anomaly =	200.333	(deg)
Period =	87.43	(min)

* Referenced to Equatorial Radius (20925721.78 ft)

TABLE 2B (CONTINUED)

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW OPENING

Flight Time: Orbit Insertion	601.11	(sec)
Radius:	21417923.	(ft)
Altitude:	520216.	(ft)
Space Fixed Velocity:	25655.04	(ft/s)
Space Fixed Flight Path Angle:	90.001	(deg)
Space Fixed Flight Azimuth:	53.244	(deg)
Earth Fixed Flight Azimuth:	51.562	(deg)
Geocentric Declination:	39.133	(deg)
Geodetic Latitude:	39.321	(deg)
Longitude: (Pos. East)	-64.890	(deg)
Inclination:	51.576	(deg)
Descending Node Argument:	158.117	(deg)
Inertial Range Angle:	18.526	(deg)
Weight:	67272.	(lbs)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	20320219.	(ft)
Ys	=	-26227.	(ft)
Zs	=	6768725.	(ft)
Xs	=	-8038.12	(ft/s)
Ys	=	-3458.48	(ft/s)
Zs	=	24116.56	(ft/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-99.635	(deg)
Yaw Attitude Angle	=	-17.257	(deg)
Roll Attitude Angle	=	-0.764	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	491994.75	(ft)
*Apogee Altitude	=	554494.77	(ft)
Eccentricity	=	.00145	
Semi-Major Axis	=	21443917.35	(ft)
True Anomaly	=	359.73	(deg)
Period	=	87.68	(min)

* Referenced to Equatorial Radius (20925721.78 ft)

TABLE 3B
 APOLLO SOYUZ TEST PROJECT
 SEQUENCE OF EVENTS
 TYPICAL LAUNCH WINDOW OPENING

FLIGHT TIME (SEC)	PROGRAM TIME (SEC)	
-17.20	---	Guidance Reference Release (GRR)
0.00	---	First Motion
0.20	(0.00) ₁	Lift-off Signal; Initiate Time Base One
59.77	---	Mach One
74.40	---	Maximum Dynamic Pressure
132.00	(131.80) ₁	Tilt Arrest
135.62	(0.00) ₂	Level Sensor Activation; Initiate Time Base Two
138.62	(3.00) ₂	Inboard Engine Cutoff (IECO)
141.62	(0.00) ₃	Outboard Engine Cutoff (OECO); Initiate Time Base Three
142.72	(1.10) ₃	Ignite Ullage Rockets
142.92	(1.30) ₃	Separation Signal
143.00	---	S-IB/S-IVB Physical Separation
144.32	(2.70) ₃	S-IVB J-2 Engine Start Command
147.72	---	90 Percent J-2 Thrust Level
150.72	---	Termination of Ullage Burn
154.92	(13.30) ₃	Jettison Ullage Rockets
166.14	---	Dynamic Pressure = 1 PSF
166.62	---	LES Jettison
171.75	(30.00) ₃	IGM Initiation
469.72	(328.10) ₃	EMR Shift Command
591.11	---	Guidance Cutoff Signal (GCS)
591.31	(0.00) ₄	Inertial Attitude Freeze, Initiate Time Base Four
601.11	---	Orbit Insertion (OI)

TABLE 4B APOLLO SOYUZ TEST PROJECT TYPICAL LAUNCH WINDOW OPENING S-1B STAGE FLIGHT DATA										
FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC ²)	DYNAMIC PRESSURE (LB/FT ²)	A.M.O.	MACH NO.	PITCH ANGLE OF ATTACK (DEG)		
1) -17.20	1311032	0	0	0.000	0	0	0.00	N/A		
2) 0.00	12966854	1613375	59	39.847	0	0	0.00	N/A		
10.00	1234179	1651115	2568	43.644	11	1601	0.49	-1.764		
20.00	11711128	1676514	9895	45.852	52	33035	0.20	-1.383		
30.00	1107765	1649600	21249	48.812	137	211485	0.33	-0.535		
40.00	1044310	1726633	34594	52.169	269	64000	0.51	0.74		
50.00	980797	1758271	53713	55.966	434	2350472	0.73	0.246		
3) 59.77	918762	1786263	147444	57.433	588	5424552	1.00	0.137		
60.00	917296	1786830	149850	57.460	591	5516370	1.01	0.133		
70.00	853472	1816950	147289	62.977	677	10446622	1.36	-0.073		
4) 74.40	825342	1828682	128178	66.318	689	13223614	1.56	-0.183		
80.00	769610	1840522	167729	70.617	668	17149977	1.85	-0.008		
90.00	725982	1853491	70696	79.018	567	24843155	2.40	-0.217		
100.00	662622	1857285	38955	68.291	316	31487624	2.94	-0.520		
110.00	599406	1854531	19639	78.498	178	36485641	3.55	-1.346		
120.00	536410	1846827	5561	116.454	91	39822450	4.22	-2.154		
130.00	473755	1834857	-1066	124.697	45	41863730	5.01	-3.103		
5) 132.00	461292	1831563	-1731	127.683	39	42167955	5.20	-3.285		
6) 135.62	436723	1824658	-3133	134.050	38	42669475	5.64	-2.564		
7) 138.62	420125	1816163	-4829	139.459	23	43017653	6.04	-1.677		
140.00	414938	728168	-4763	120.333	22	43150272	6.17	-1.337		
8) 141.62	408807	603133	-4946	63.598	19	43328663	6.32	-0.848		
9) 142.72	407913	55545	-4573	40.748	16	43428470	6.36	-0.576		
10) 142.92	407159	57476	-4486	40.696	10	43442184	6.36	-0.532		
11) 143.40	407130	54574	-4444	40.666	100	43447241	6.36	-0.517		

- 1) Guidance Reference Release
- 2) First Motion
- 3) Mach One
- 4) Maximum Dynamic Pressure
- 5) Tilt Arrest
- 6) LSA, Initiate Time Base Two
- 7) IECO
- 8) OECO, Initiate Time Base Three
- 9) Ignite Ullage Rockets
- 10) Separation Signal
- 11) S-IB/S-IVB Physical Separation

TABLE 5B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	---- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
-17.20	20910035.	1346.44	90.000	20909952.	45610.	-37345.	0.00	849.19	1037.14
0.00	20910034.	1346.44	90.000	20909939.	60211.	-19501.	-1.48	848.57	1037.65
10.00	20910497.	1343.56	85.853	20910383.	68693.	-9123.	94.64	847.86	1037.92
20.00	20912659.	1366.00	80.739	20711917.	7169.	-1290.	216.74	847.36	1050.04
30.00	20914944.	1432.96	75.062	20914806.	85640.	11992.	365.29	847.07	1096.54
40.00	20919536.	1553.72	69.449	20919311.	94119.	23356.	540.27	849.27	1183.59
50.00	20925979.	1739.09	64.558	20925697.	102035.	35833.	740.66	853.92	1321.62
59.77	20934317.	1983.02	61.084	20933964.	110977.	49642.	951.00	857.72	1514.81
60.00	20934539.	1989.91	61.026	20934164.	111195.	49993.	955.78	857.80	1520.00
70.00	20945240.	2366.21	59.120	20944792.	119860.	66436.	1169.99	863.73	1782.15
74.40	20950669.	2466.29	58.578	20950172.	123669.	74596.	1273.85	865.66	1926.28
80.00	20958257.	2745.37	58.155	20957687.	128459.	85951.	1413.36	867.62	2137.44
90.00	20973856.	3214.89	58.217	20973122.	137127.	109558.	1674.11	864.97	2604.74
100.00	20992140.	3839.17	59.200	20991178.	145759.	138483.	1938.81	861.84	3199.61
110.00	21013215.	4585.10	60.582	21011927.	154366.	173966.	2211.02	859.44	3917.91
120.00	21037151.	5448.91	62.236	21035398.	162945.	217310.	2482.56	856.12	4774.40
130.00	21063982.	6463.94	64.062	21061554.	171481.	269994.	2746.54	850.53	5789.27
132.00	21069695.	6686.51	64.440	21067099.	173180.	281797.	2797.86	849.14	6013.34
135.62	21080344.	7168.05	65.113	21071410.	176254.	304362.	2691.68	846.48	6437.86
138.62	21089464.	7475.38	65.595	21080213.	178790.	324225.	2977.41	844.19	6804.68
140.00	21093726.	7576.77	65.825	21090319.	179956.	333665.	2986.80	843.42	6911.96
141.62	21098772.	7667.45	66.100	21095173.	181320.	344462.	2985.85	842.80	7013.91
142.72	21102181.	7677.27	66.306	21098446.	182247.	352714.	2960.17	842.51	7033.10
142.92	21102797.	7675.73	66.345	21099038.	182415.	354121.	2954.88	842.46	7033.90
143.00	21103029.	7675.13	66.366	21099259.	182478.	354648.	2952.67	842.45	7034.18

TABLE 6B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
-17.20	295.	.30	N/A	295.	0.	0.	.00	.00	.00
0.00	295.	.30	N/A	295.	0.	0.	.00	.00	.00
10.00	758.	97.17	400	758.	-20.	-60.	97.17	-0.47	-0.17
20.00	2320.	220.24	300.63	2320.	-9.	29.	219.95	-0.87	11.30
30.00	5256.	373.84	80.861	5245.	-24.	339.	369.49	-1.20	56.90
40.00	9885.	564.62	14.759	9799.	-25.	1361.	545.66	.84	142.75
50.00	16569.	798.00	40.575	16245.	5.	3362.	747.54	5.27	279.21
59.07	25560.	1068.95	26.201	24588.	76.	6979.	959.79	8.88	470.52
60.00	25803.	1075.56	26.333	24611.	78.	7089.	964.62	8.95	475.66
70.00	37851.	1391.73	31.976	35519.	175.	13677.	1181.38	14.83	735.55
74.45	44220.	1554.64	34.386	40953.	295.	16625.	1286.62	16.80	878.54
32 80.00	53345.	1795.55	37.348	48545.	365.	22113.	1420.16	18.89	1088.12
90.00	73179.	2297.27	42.516	69149.	548.	35211.	1693.43	16.83	1552.25
100.00	98321.	2917.35	47.456	82126.	704.	53544.	1964.12	14.99	2143.52
110.00	129875.	3633.56	51.748	103460.	833.	78496.	2244.62	14.70	2657.78
120.00	169553.	4487.72	55.556	127513.	999.	111217.	2525.20	14.59	3709.82
130.00	217217.	5464.63	58.994	153755.	1112.	153232.	2801.40	13.64	4719.88
132.00	228062.	57.0.49	59.644	159613.	1107.	162895.	2855.50	13.38	4942.95
135.02	248837.	6125.34	61.768	176143.	1216.	181576.	2954.64	12.96	5365.61
138.62	267178.	6489.50	61.579	179141.	1255.	198219.	3045.07	12.65	5730.80
140.00	275912.	6589.19	61.967	183342.	1272.	206183.	3056.20	12.67	5837.54
141.02	286377.	6679.63	62.278	188309.	1293.	215753.	3057.13	12.94	5938.96
142.72	293521.	6685.55	62.519	191662.	1307.	222303.	3032.95	13.14	5957.99
142.92	294819.	6683.64	62.563	192266.	1310.	223494.	3027.21	13.18	5958.76
143.00	295306.	6682.90	62.579	192195.	1311.	223941.	3029.64	13.20	5959.04

TABLE 7B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEOGRAPHIC LATITUDE (DEG)
-17.24	0.	0.000	0.00	90.000	N/A	-80.621	28.466	28.627
0.00	295.	0.000	3.91	90.000	N/A	-80.621	28.466	28.627
10.00	758.	0.001	97.28	89.978	39.397	-80.621	28.466	28.627
20.00	2321.	0.006	220.17	89.641	44.085	-80.620	28.466	28.627
30.00	5246.	0.058	372.61	88.927	48.691	-80.620	28.466	28.628
40.00	9800.	0.217	554.18	86.462	50.554	-80.618	28.468	28.630
50.00	16246.	0.558	785.56	83.509	51.438	-80.613	28.472	28.633
59.77	24590.	1.155	1044.29	80.263	51.521	-80.604	28.478	28.639
64.00	24812.	1.173	1050.52	80.101	51.521	-80.604	28.478	28.640
70.00	35524.	2.159	1348.22	76.669	51.658	-80.589	28.488	28.650
74.46	46960.	2.743	1506.23	74.955	51.620	-80.586	28.494	28.656
80.00	48557.	3.645	1744.94	72.657	51.545	-80.567	28.504	28.665
90.00	64179.	5.796	2279.63	69.154	51.215	-80.535	28.526	28.688
100.00	82496.	8.810	2884.33	65.893	51.037	-80.491	28.558	28.719
110.00	103614.	12.886	3575.00	63.235	50.977	-80.431	28.600	28.762
120.00	127648.	16.231	4106.24	61.007	50.958	-80.352	28.656	28.819
130.00	154514.	25.679	5413.68	59.350	50.958	-80.251	28.728	28.891
132.00	160244.	26.052	5648.55	59.046	50.960	-80.228	28.745	28.907
135.62	176926.	24.092	6161.05	58.530	50.969	-80.183	28.776	28.939
138.62	180075.	32.397	6419.23	58.138	50.978	-80.143	28.805	28.968
140.00	184351.	33.691	6513.32	58.036	50.986	-80.124	28.818	28.981
141.62	189414.	35.246	6614.76	57.947	50.999	-80.101	28.835	28.998
142.72	192835.	36.309	6621.03	57.938	51.009	-80.085	28.846	29.009
142.92	193453.	36.563	6618.64	57.939	51.011	-80.082	28.848	29.011
143.00	193685.	36.575	6617.47	57.939	51.011	-80.081	28.849	29.012

TABLE 8B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-18 STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
-17.2	+0.000	+0.000	-39.310	+0.003	+0.002	+0.002	+0.000	+0.000	+0.000
-16.0	+0.049	+0.048	-39.276	+0.003	+0.002	+0.002	+0.049	+0.046	+0.034
16.0	+0.022	+0.010	-39.310	+0.001	+0.001	+0.000	+0.011	+0.022	+0.000
26.0	+3.512	+0.014	-30.742	+0.417	+0.000	+0.004	+283	+161	+0.932
36.0	+7.763	+0.013	-26.746	+0.441	+0.005	+0.006	+341	+143	+0.930
46.0	+12.365	+0.211	-16.741	+0.496	+0.006	+0.006	+439	+100	+0.931
56.0	+17.776	+0.160	-0.757	+0.549	+0.024	+0.26	+455	+0.155	+0.654
59.77	+23.227	+0.508	+0.003	+0.550	+0.12	+0.01	+397	+0.508	+0.005
60.00	+23.355	+0.511	+0.003	+0.555	+0.14	+0.01	+399	+0.511	+0.004
70.00	+29.062	+0.650	+0.05	+0.591	+0.43	+0.01	+535	+0.650	+0.002
74.4	+31.714	+0.671	+0.10	+0.611	+0.25	+0.01	+619	+0.671	+0.006
80.00	+35.323	+0.520	+0.04	+0.670	+0.26	+0.02	+671	+0.520	+0.001
90.00	+42.545	+0.465	+0.02	+0.770	+0.36	+0.03	+661	+0.085	+0.001
100.00	+47.936	+0.112	+0.09	+0.501	+0.03	+0.01	+436	+0.012	+0.009
110.00	+52.819	+0.046	+0.17	+0.495	+0.02	+0.00	+439	+0.045	+0.017
120.00	+57.506	+0.068	+0.14	+0.404	+0.02	+0.00	+444	+0.069	+0.013
130.00	+62.346	+0.164	+0.16	+0.464	+0.02	+0.00	+405	+0.164	+0.009
132.00	+63.267	+0.169	+0.09	+0.476	+0.02	+0.00	+425	+0.169	+0.008
135.62	+63.819	+0.172	+0.07	+0.505	+0.01	+0.03	+407	+0.172	+0.007
138.62	+63.742	+0.172	+0.05	+0.613	+0.01	+0.00	+0.79	+0.172	+0.005
140.00	+63.769	+0.128	+0.04	+0.615	+0.04	+0.01	+0.77	+0.120	+0.004
141.62	+63.762	+0.077	+0.03	+0.615	+0.09	+0.01	+0.60	+0.077	+0.003
142.72	+63.756	+0.069	+0.04	+0.605	+0.12	+0.03	+0.43	+0.069	+0.004
142.92	+63.757	+0.066	+0.04	+0.604	+0.14	+0.04	+0.45	+0.060	+0.004
143.00	+63.756	+0.065	+0.05	+0.616	+0.15	+0.04	+0.46	+0.065	+0.005

TABLE 9B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC ²)	DYNAMIC PRESSURE (LB/FT ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1) 143.00	306911.	9809.	743.	.864	16.	1.128	-63.712	-517
2) 144.32	306611.	8984.	637.	.878	13.	1.153	-63.712	-286
3) 147.72	305346.	180766.	444.	19.002	90.	1.216	-63.712	-088
4) 150.72	303952.	194877.	313.	26.666	0.	1.272	-63.712	.939
5) 154.92	301658.	229119.	194.	24.418	4.	1.352	-63.712	2.342
6) 160.00	298860.	229156.	112.	24.664	2.	1.456	-63.712	3.403
7) 166.14	289173.	229259.	58.	25.503	1.	1.571	-63.712	4.749
8) 166.62	288014.	229241.	55.	25.603	1.	1.580	-63.712	4.857
170.00	284156.	229e05.	36.	25.994	1.	1.647	-63.712	5.590
171.75	283208.	230695.	31.	26.205	0.	1.683	-63.712	5.958
180.00	274736.	230031.	23.	26.551	0.	1.851	-56.311	14.342
190.00	273316.	230062.	7.	27.082	0.	2.060	-57.281	15.870
200.00	267901.	230078.	2.	27.631	0.	2.275	-58.336	16.612
210.00	262494.	229580.	1.	26.139	0.	2.495	-59.220	17.338
220.00	257089.	229436.	0.	28.709	0.	2.722	-60.243	17.888
230.00	251697.	228951.	0.	29.206	0.	2.954	-61.104	18.570
240.00	246304.	228852.	0.	29.694	0.	3.193	-62.193	19.002
250.00	240921.	228527.	0.	30.519	0.	3.439	-63.063	19.514
260.00	235538.	228521.	0.	31.215	0.	3.691	-64.066	19.887
270.00	230141.	228832.	0.	31.991	0.	3.949	-65.299	19.901
280.00	224747.	228984.	0.	32.786	0.	4.215	-66.272	20.171
290.00	219347.	228794.	0.	33.559	0.	4.489	-67.375	20.225
300.00	213950.	228554.	0.	34.370	0.	4.770	-68.440	20.254
310.00	208563.	228688.	0.	35.278	0.	5.058	-69.365	20.387
320.00	203175.	228522.	0.	36.187	0.	5.355	-70.439	20.352
330.00	197793.	228707.	0.	37.203	0.	5.660	-71.432	20.348
340.00	192388.	229470.	0.	38.308	0.	5.974	-72.729	20.069
350.00	186996.	228736.	0.	39.357	0.	6.297	-73.759	19.823
360.00	181593.	228554.	0.	40.493	0.	6.629	-74.721	19.687
370.00	176208.	228307.	0.	41.680	0.	6.971	-75.764	19.431
380.00	170808.	229072.	0.	43.148	0.	7.322	-76.913	19.664
390.00	165411.	227948.	0.	44.330	0.	7.665	-78.012	18.617
400.00	160026.	227916.	0.	45.823	0.	8.056	-78.900	18.415
410.00	154541.	227353.	0.	47.403	0.	8.442	-80.085	18.012
420.00	147258.	227799.	0.	49.104	0.	8.838	-81.204	17.585

- 1) S-IB/S-IVB Physical Separation
- 2) S-IVB Start Command
- 3) J-2 90 Percent Thrust
- 4) Termination of Ullage Burn
- 5) Jettison Ullage Rockets
- 6) Dynamic Pressure = 1 PSF
- 7) LES Jettison
- 8) IGM Initiation

TABLE 9B (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC ²)	DYNAMIC PRESSURE (LB/FT ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
430.00	143871.	228525.	0.	51.104	0.	9.246	-82.317	17.086
440.00	138469.	228730.	0.	53.146	0.	9.667	-83.527	16.421
450.00	133479.	227862.	0.	55.389	0.	10.101	-84.589	15.864
460.00	127693.	227808.	0.	57.399	0.	10.549	-85.702	15.311
470.00	122405.	227670.	0.	59.892	0.	11.011	-86.836	14.751
9) 470.25	122281.	205195.	0.	53.989	0.	11.023	-86.864	14.737
480.00	117759.	193111.	0.	52.761	0.	11.488	-87.919	14.242
490.00	113230.	193080.	0.	54.862	0.	11.976	-89.013	13.787
500.00	108701.	193051.	0.	57.137	0.	12.481	-90.041	13.276
510.00	104173.	193012.	0.	59.511	0.	13.006	-91.146	12.678
520.00	99646.	192971.	0.	62.310	0.	13.534	-92.322	11.972
530.00	95119.	192926.	0.	65.256	0.	14.084	-93.491	11.273
540.00	90593.	192877.	0.	68.497	0.	14.651	-94.701	10.567
550.00	86052.	193757.	0.	72.443	0.	15.235	-96.047	9.798
560.00	81512.	193038.	0.	70.193	0.	15.838	-97.233	9.106
570.00	76941.	192939.	0.	80.633	0.	16.461	-99.596	7.845
580.00	72459.	192831.	0.	85.638	0.	17.105	-99.622	7.486
590.00	67730.	192597.	0.	91.200	0.	17.771	-99.499	8.099
10) 591.11	67438.	192564.	0.	91.366	0.	17.846	-99.499	8.143
600.00	67278.	0.	0.	-0.000	0.	18.451	-99.499	8.756
11) 601.11	67273.	0.	1.	-0.000	0.	18.526	-99.635	8.834

9) EMR Shift

10) Guidance Cutoff Signal

11) Orbit Insertion

TABLE 10B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
143.60	21103050.	7675.16	66.361	21099280.	182482.	354695.	2952.55	842.44	7034.19
144.32	21107091.	7659.54	66.621	21103153.	163594.	363986.	2911.27	842.16	7034.47
147.72	21117261.	7634.19	67.289	21112875.	186456.	367912.	2811.14	841.89	7047.66
150.72	21126012.	7658.14	67.851	21121205.	188984.	469133.	2742.61	842.87	7100.26
154.92	21137979.	7709.33	68.607	21132541.	192523.	439138.	2655.61	841.88	7188.31
160.66	21152025.	7775.63	69.498	21145755.	196790.	475892.	2551.66	839.54	7296.19
166.14	21168417.	7859.91	70.550	21161638.	201936.	521094.	2427.16	836.70	7428.79
166.62	21169684.	7867.01	70.632	21162213.	202342.	524699.	2417.43	836.51	7439.50
170.00	21178394.	7917.96	71.193	21170258.	205162.	549934.	2350.27	834.72	7514.89
171.75	21182835.	7945.17	71.480	21174341.	206622.	563119.	2315.66	833.74	7554.36
180.40	21203112.	8175.72	72.730	21192788.	213473.	626207.	2161.78	825.55	7737.08
190.00	21226442.	8237.71	74.617	21213585.	221062.	764646.	1997.05	811.67	7950.65
200.00	21248484.	8416.88	75.258	21232727.	229097.	765246.	1831.13	794.89	8170.56
210.00	21269253.	8594.60	76.448	21256264.	237552.	860070.	1664.14	775.62	8396.20
220.00	21288773.	8789.05	77.581	21266016.	245262.	953184.	1496.78	754.00	8627.78
230.00	21307064.	8993.63	78.061	21280137.	252624.	1040644.	1320.38	729.86	8864.99
240.00	21324150.	9208.87	79.683	21292578.	259796.	1130505.	1159.48	702.81	9108.51
250.00	21340354.	9434.47	80.656	21303320.	266072.	1222834.	986.66	672.96	9358.34
260.00	21354777.	9670.58	81.573	21312353.	273236.	1317694.	817.38	639.81	9614.71
270.00	21368409.	9916.69	82.440	21319665.	279457.	1415158.	644.29	603.47	9879.32
280.00	21380935.	10177.86	83.259	21325233.	285297.	1515105.	468.92	563.88	10151.34
290.00	21392313.	10448.46	84.028	21329039.	296723.	1618212.	291.81	520.62	10431.40
300.00	21402657.	10736.71	84.749	21331663.	295698.	1723961.	114.38	473.67	10719.67
310.00	21411962.	11024.05	85.424	21331279.	300184.	1832631.	-69.43	422.77	11015.72
320.00	21420260.	11329.27	86.150	21327666.	304140.	1944304.	-253.48	367.68	11320.46
330.00	21427579.	11646.33	86.633	21326260.	307524.	2059069.	-440.54	308.41	11633.91
340.00	21433954.	11977.32	87.171	21326850.	310292.	2177021.	-630.25	244.49	11958.23
350.00	21439410.	12321.72	87.672	21315580.	312401.	2298268.	-824.59	176.44	12292.83
360.00	21443978.	12678.99	88.130	21304346.	313604.	2422910.	-1022.37	103.24	12637.28
370.00	21447699.	13049.86	88.547	21293122.	314449.	2551050.	-1223.62	24.87	12992.35
380.00	21450612.	13435.80	88.923	21274804.	314283.	2682797.	-1428.81	-58.94	13359.48
390.00	21452762.	13837.46	89.264	21264528.	313253.	2816282.	-1634.47	-147.93	13739.20
400.00	21454184.	14253.48	89.567	21247601.	311304.	2957619.	-1854.55	-292.98	14130.22
410.00	21454936.	14666.35	89.831	21227421.	308373.	3104934.	-2074.59	-344.39	14535.00
420.00	21455367.	15137.13	90.661	21205550.	304395.	3248369.	-2300.71	-452.22	14954.43

TABLE 308 (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-48 STAGE FLIGHT DATA

FLIGHT TIME (SEC)	---- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)	
430.00	21454632.	15007.16	90.257	21181386.	249305.	3403076.	-2533.24	-567.03	15389.70	
440.00	21453691.	16099.38	90.418	21154863.	293029.	3556227.	-2772.60	-689.47	15843.50	
450.00	21452306.	16011.50	90.547	21125945.	265491.	3717001.	-3020.29	-819.45	16314.05	
460.00	21450548.	17146.56	90.641	21094433.	276610.	3882573.	-3275.43	-958.11	16803.52	
470.00	21448475.	17766.45	90.703	21060367.	266296.	4053143.	-3534.47	-1105.86	17313.80	
470.25	21448441.	17726.35	90.705	21057462.	266021.	4057473.	-3546.22	-1109.56	17326.40	
480.00	21446126.	18204.81	90.855	21023591.	254572.	4226493.	-3817.45	-1240.43	17756.79	
490.00	21443484.	18722.31	90.880	20983990.	241463.	4400336.	-4104.29	-1382.43	18214.52	
500.00	21441410.	19262.02	90.922	20941478.	226094.	4592845.	-4399.68	-1533.03	18690.05	
510.00	21437239.	19825.97	90.933	20893964.	210769.	4782262.	-4704.60	-1693.74	19184.61	
520.00	21433983.	20715.21	90.917	20847341.	192985.	4976669.	-5021.34	-1864.79	19699.99	
530.00	21430740.	21333.22	90.872	20793450.	173336.	5176281.	-5350.45	-2046.86	20238.07	
540.00	21427616.	21082.38	90.805	20740268.	152004.	5381456.	-5693.67	-2240.30	20801.17	
550.00	21421726.	22368.63	90.730	20681569.	128587.	5592410.	-6053.31	-2445.92	21394.64	
560.00	21422185.	23393.31	90.577	20619156.	103051.	5809450.	-6434.25	-2663.45	22018.93	
570.00	21420128.	23857.64	90.423	20552867.	75257.	6032499.	-6828.88	-2898.21	22674.96	
580.00	21418644.	24069.66	90.268	20482437.	45015.	6263070.	-7250.50	-3152.54	23365.95	
590.00	21417947.	25320.34	90.139	20407679.	12158.	6503380.	-7694.01	-3420.88	24103.95	
591.11	21417935.	25031.12	90.009	20397142.	8358.	6527066.	-7742.59	-3451.51	24100.71	
600.00	21417928.	25055.07	90.001	20327091.	-22403.	6742047.	-8005.93	-3458.56	24127.29	
601.11	21417927.	25055.04	90.001	20322170.	-26427.	6768725.	-8030.12	-3458.48	24116.56	

TABLE 116
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	---- EARTH FIXED -----				---- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)	
143.00	295333.	6682.86	62.593	192517.	1311.	223484.	3024.93	13.20	5959.05	
144.52	303917.	6664.84	62.869	196485.	1329.	231356.	2984.55	13.46	5959.23	
147.72	325875.	6633.28	63.619	200460.	1375.	252124.	2880.83	14.67	5972.13	
150.72	345253.	6652.14	64.276	215321.	1423.	270118.	2820.99	17.09	6024.34	
154.92	372522.	6696.96	65.171	226693.	1499.	295603.	2737.63	18.21	6111.84	
160.00	405736.	6755.57	66.229	240334.	1592.	326892.	2638.15	18.53	6219.12	
166.14	446316.	6832.43	67.477	256164.	1708.	365479.	2514.98	19.14	6351.10	
166.62	449541.	6838.73	67.574	257383.	1717.	368562.	2509.70	19.17	6361.76	
170.00	472367.	6885.82	68.241	265745.	1742.	390158.	2445.66	19.32	6436.84	
171.75	483807.	6911.02	68.582	269946.	1816.	401457.	2412.68	19.38	6476.17	
180.00	539721.	7033.48	70.070	289276.	1909.	455647.	2266.59	16.16	6656.23	
190.00	608819.	7186.19	71.606	311169.	2074.	523288.	2111.49	8.46	6871.07	
200.00	679452.	7355.26	73.083	331505.	2131.	593090.	1955.54	-1.66	7090.53	
210.00	751716.	7533.92	74.495	350277.	2055.	665118.	1790.87	-13.78	7316.00	
220.00	825715.	7724.32	75.536	367484.	1849.	739431.	1642.21	-27.76	7547.69	
230.00	901547.	7925.76	77.108	363121.	1493.	810091.	1484.87	-43.77	7785.30	
240.00	979318.	8136.72	78.309	397182.	966.	895159.	1327.43	-62.19	8029.50	
250.00	1059137.	8362.80	79.445	409663.	243.	976703.	1168.65	-82.66	8280.33	
260.00	1141113.	8596.12	80.513	420555.	-706.	1060788.	1009.41	-166.30	8538.01	
270.00	1225363.	8846.58	81.517	429858.	-1892.	1147493.	849.00	-132.36	8804.25	
280.00	1312007.	9105.61	82.461	437536.	-3356.	1236899.	680.75	-161.09	9078.24	
290.00	1461164.	9377.22	83.343	443582.	-5123.	1329086.	523.20	-192.88	9360.63	
300.00	1452957.	9664.89	84.166	447789.	-7224.	1424140.	357.79	-227.73	9651.57	
310.00	1587516.	9956.07	84.931	450732.	-9688.	1522144.	190.47	-265.91	9950.69	
320.00	1664934.	10263.51	85.639	451794.	-12553.	1623185.	21.38	-307.62	10258.88	
330.00	1765367.	10583.12	86.295	451152.	-15852.	1727352.	-150.21	-352.82	10576.18	
340.00	1868935.	10916.98	86.896	448785.	-19623.	1834748.	-323.91	-401.95	10904.77	
350.00	1955796.	11261.46	87.453	444666.	-23901.	1945484.	-561.66	-454.44	11244.10	
360.00	2116071.	11625.06	87.961	438743.	-28726.	2059664.	-682.35	-511.32	11593.74	
370.00	2219946.	11994.47	88.426	431005.	-34142.	2177396.	-865.92	-572.57	11954.48	
380.00	2337449.	12389.12	88.832	421414.	-40193.	2298796.	-1052.83	-638.43	12327.79	
390.00	2456863.	12794.63	89.204	409933.	-46924.	2423977.	-1244.55	-768.56	12714.22	
400.00	2564295.	13214.62	89.533	396512.	-54302.	2553120.	-1440.08	-783.67	13112.51	
410.00	2713919.	13651.06	89.819	381118.	-62619.	2686296.	-1639.68	-864.58	13525.14	
420.00	284793.	1416.57	90.666	363498.	-71691.	2023674.	-1645.06	-950.70	13953.04	

TABLE 11B (Continued)
 APOLLO-SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 5-48 STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
430.00	2986438.	14586.81	90°275	314196.	-81653.	2965412.	-2055.86	-1042.72	14397.44
440.00	3129743.	15077.13	90°446	322561.	-92508.	3111690.	-222.91	-1141.21	14861.07
450.00	3278004.	15593.94	90°583	29817.	-104496.	3262692.	-249.64	-1246.05	15342.20
460.00	3431466.	16133.45	90°682	272599.	-117514.	341861.	-2727.96	-1358.33	15843.03
470.00	3598358.	16697.83	90°746	249132.	-131691.	3579626.	-2966.66	-1478.35	16365.51
470.25	3594442.	16711.84	90°747	24339.	-13261.	3583719.	-2972.97	-1481.34	16378.42
480.00	3754499.	17200.06	90°852	213204.	-147604.	3745557.	-3220.48	-1585.22	16821.34
490.00	3923638.	17721.45	90°929	179097.	-163417.	3916113.	-3482.19	-1698.27	17292.77
510.00	4297992.	18265.69	90°972	143535.	-180994.	4091477.	-3751.62	-1818.61	17782.90
510.00	4277791.	16832.65	90°983	114036.	-199618.	4271846.	-4029.92	-1947.03	18293.04
520.00	4403281.	19426.34	90°964	62902.	-214976.	4757413.	-4318.69	-2065.48	18825.05
530.00	4654731.	26048.45	90°915	18249.	-24150.	4648423.	-4619.04	-2232.70	19380.91
540.00	4852434.	26761.76	90°838	-29522.	-264663.	4845121.	-4932.41	-2359.53	19963.01
550.00	5056723.	21392.04	90°732	-64747.	-289387.	5047794.	-5260.95	-2556.55	20576.63
560.00	5267974.	42120.74	90°663	-134652.	-315827.	5256770.	-5607.46	-2733.35	21222.92
570.00	5486562.	22889.19	90°441	-192676.	-344106.	5472368.	-5970.38	-2925.18	21902.35
580.00	5712897.	23705.41	90°279	-254347.	-374393.	5694939.	-6364.94	-3133.87	22618.86
590.00	5947476.	24572.16	90°041	-319786.	-406824.	5924912.	-6703.49	-3354.20	23383.66
591.01	5973951.	24671.38	90°010	-327191.	-410548.	5956823.	-6807.86	-3379.35	23471.47
600.01	6187462.	24845.13	90°051	-349150.	-440552.	6159478.	-7054.15	-3361.08	23426.29
601.01	6214306.	24695.00	90°021	-376967.	-444266.	6185381.	-7084.36	-3357.91	23417.58

TABLE 12B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
143.86	19357.	36.582	6617.36	57.939	51.011	-80.081	28.849	29.012
144.32	197761.	37.860	6596.25	57.950	51.024	-80.062	28.862	29.025
147.72	207967.	41.147	6507.37	57.972	51.061	-80.014	28.896	29.060
150.72	216750.	41.064	6525.35	57.961	51.106	-79.970	28.927	29.090
154.92	228752.	48.192	6569.36	57.914	51.146	-79.909	28.970	29.133
160.03	242862.	53.255	6626.37	57.852	51.186	-79.834	29.023	29.187
166.14	259322.	59.492	6701.78	57.780	51.236	-79.742	29.088	29.252
166.62	260595.	59.990	6704.17	57.774	51.240	-79.734	29.093	29.257
170.03	269343.	63.477	6754.32	57.732	51.266	-79.682	29.130	29.293
171.75	273864.	63.361	6779.13	57.711	51.280	-79.655	29.149	29.313
180.00	294176.	74.041	6900.38	57.593	51.315	-79.525	29.240	29.404
190.00	317625.	84.934	7053.38	57.440	51.329	-79.363	29.353	29.518
230.00	337789.	96.160	7219.22	57.219	51.331	-79.195	29.470	29.635
210.00	360685.	107.730	7396.83	57.114	51.325	-79.022	29.590	29.756
220.00	380333.	119.654	7586.32	56.948	51.314	-78.844	29.714	29.880
230.00	398763.	131.745	7786.98	56.783	51.296	-78.660	29.842	30.008
240.00	415989.	144.612	7999.35	56.639	51.272	-78.470	29.974	30.141
250.00	432937.	157.670	8222.85	56.437	51.243	-78.274	30.110	30.277
260.00	446930.	171.129	8457.75	56.202	51.207	-78.072	30.250	30.418
270.00	460696.	185.003	8705.38	56.034	51.167	-77.864	30.395	30.563
280.00	473353.	197.309	8964.65	55.977	51.124	-77.648	30.545	30.713
290.00	484927.	214.060	9236.09	55.727	51.076	-77.426	30.699	30.868
300.00	495443.	227.273	9519.64	55.548	51.024	-77.197	30.858	31.028
310.00	504926.	244.963	9814.76	55.368	50.970	-76.960	31.023	31.193
320.00	513408.	261.146	10122.20	55.187	50.912	-76.716	31.193	31.363
330.00	520919.	277.839	10441.84	55.008	50.853	-76.463	31.368	31.539
340.00	527491.	295.061	10775.76	54.829	50.793	-76.233	31.549	31.721
350.00	533153.	312.832	11123.31	54.654	50.734	-75.933	31.736	31.909
360.00	537934.	331.173	11484.01	54.406	50.674	-75.655	31.930	32.103
370.00	541875.	353.104	11858.54	54.308	50.614	-75.367	32.130	32.303
380.00	545017.	369.647	12248.32	54.139	50.555	-75.070	32.337	32.511
390.00	547484.	389.825	12653.95	53.975	50.500	-74.762	32.550	32.725
400.00	549073.	410.664	13074.07	53.815	50.446	-74.444	32.771	32.947
410.00	550081.	432.187	13511.17	53.659	50.394	-74.115	33.000	33.176
420.00	553477.	454.422	13966.26	53.509	50.346	-73.774	33.236	33.413

TABLE 12B (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEOGRAPHIC LATITUDE (DEG)
430.00	554317.	477.399	14445.61	53.364	50.303	-73.421	33.461	33.658
440.00	549663.	341.151	14937.62	53.225	50.264	-73.055	33.734	33.912
450.00	546575.	325.713	15453.90	53.094	50.231	-72.676	33.996	34.174
460.00	547126.	351.119	15893.47	52.969	50.203	-72.283	34.267	34.446
470.00	545394.	377.468	16557.89	52.852	50.182	-71.875	34.548	34.727
470.25	545348.	378.077	16571.94	52.850	50.182	-71.864	34.555	34.735
480.00	543358.	644.553	17059.96	52.797	50.211	-71.452	34.837	35.018
490.00	540979.	632.516	17581.22	52.756	50.247	-71.014	35.136	35.317
500.00	538341.	661.332	18124.68	52.711	50.289	-70.561	35.443	35.625
510.00	535537.	691.044	18692.56	52.677	50.336	-70.092	35.759	35.942
520.00	532661.	721.676	19285.53	52.651	50.390	-69.666	36.066	36.269
530.00	529812.	753.291	19967.46	52.634	50.452	-69.162	36.422	36.606
540.00	527194.	785.927	20561.37	52.628	50.524	-68.579	36.768	36.953
550.00	524625.	819.644	21251.38	52.635	50.610	-68.035	37.126	37.311
560.00	522520.	854.491	21976.71	52.640	50.712	-67.469	37.494	37.680
570.00	521914.	896.541	22746.75	52.673	50.822	-66.880	37.875	38.062
580.00	519898.	927.656	23562.54	52.734	50.939	-66.266	38.268	38.455
590.00	519686.	966.520	24428.76	52.621	51.082	-65.625	38.674	38.862
591.11	519729.	976.882	24527.44	52.614	51.099	-65.553	38.720	38.908
600.00	521163.	1116.066	24550.31	53.175	51.539	-64.963	39.088	39.276
601.11	520216.	1116.442	24550.46	53.244	51.562	-64.890	39.133	39.321

TABLE 138
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW OPENING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
143.00	-63.758	-0.065	0.005	-0.010	0.015	0.004	-0.046	-0.065	0.005
144.32	-63.824	0.025	0.119	-0.082	0.134	0.017	-0.112	-0.025	0.019
147.72	-64.184	1.025	0.138	-0.040	0.255	0.086	-0.471	1.025	0.135
150.72	-63.887	0.751	0.158	0.175	0.315	0.098	-0.173	0.752	0.157
154.92	-63.466	-0.330	-0.288	0.008	0.088	0.104	0.247	-0.330	-0.289
160.00	-63.586	-0.277	-0.291	-0.019	0.018	0.028	0.127	-0.277	-0.291
166.14	-63.638	-0.348	-0.302	-0.005	-0.021	0.087	0.075	-0.348	-0.302
166.62	-63.641	-0.358	-0.262	-0.005	-0.020	0.078	0.072	-0.358	-0.262
170.00	-63.662	-0.413	-0.105	-0.009	-0.009	0.017	0.051	-0.413	-0.106
171.75	-63.678	-0.423	-0.098	-0.010	-0.003	-0.008	0.034	-0.423	-0.098
180.00	-56.982	-1.925	0.552	0.888	0.007	0.018	-0.672	-0.416	0.572
190.00	-57.241	-2.395	-0.391	-0.067	-0.054	-0.068	0.041	-0.370	-0.392
200.00	-58.228	-2.903	-0.311	-0.130	-0.041	0.039	0.109	-0.392	-0.316
210.00	-59.161	-3.268	0.133	-0.087	-0.040	0.043	0.058	-0.403	0.130
220.00	-60.199	-3.656	0.493	-0.095	-0.041	0.037	0.041	-0.402	0.487
230.00	-61.043	-4.121	0.693	-0.089	-0.046	0.049	0.058	-0.412	0.689
240.00	-62.094	-4.538	0.148	-0.133	-0.034	0.065	0.097	-0.429	0.137
250.00	-63.009	-5.017	-0.368	-0.089	-0.049	-0.051	0.055	-0.420	-0.372
260.00	-63.994	-5.483	-0.685	-0.105	-0.044	0.031	0.074	-0.434	-0.692
270.00	-65.255	-5.858	-0.448	-0.103	-0.046	0.031	0.046	-0.430	-0.452
280.00	-66.201	-6.350	-0.106	-0.101	-0.047	0.031	0.072	-0.448	-0.113
290.00	-67.304	-6.785	0.169	-0.108	-0.044	0.028	0.070	-0.455	0.161
300.00	-68.377	-7.231	0.447	-0.111	-0.044	0.026	0.060	-0.460	0.439
310.00	-69.290	-7.737	0.779	-0.103	-0.045	0.028	0.072	-0.476	0.770
320.00	-70.371	-8.171	0.328	-0.106	-0.045	-0.054	0.066	-0.480	0.318
330.00	-71.383	-8.632	-0.197	-0.095	-0.048	-0.050	0.049	-0.481	-0.204
340.00	-72.624	-8.992	-0.729	-0.143	-0.029	0.013	0.107	-0.510	-0.745
350.00	-73.742	-9.442	-0.465	-0.109	-0.054	0.027	0.019	-0.514	-0.468
360.00	-74.701	-9.906	-0.141	-0.102	-0.044	0.029	0.020	-0.531	-0.145
370.00	-75.740	-10.329	0.138	-0.135	-0.042	0.027	0.023	-0.541	0.134
380.00	-76.853	-10.715	0.375	-0.134	-0.029	0.013	0.058	-0.566	0.365
390.00	-78.016	-11.094	0.584	-0.088	-0.051	0.034	-0.06	-0.548	0.584
400.00	-78.929	-11.565	0.507	-0.110	-0.038	-0.054	0.028	-0.576	0.501
410.00	-80.058	-11.933	-0.050	-0.114	-0.037	-0.056	0.026	-0.583	-0.056
420.00	-81.104	-12.304	-0.614	-0.112	-0.037	-0.056	0.023	-0.591	-0.618

TABLE 138 (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW OPENING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
436.00	-02.287	-12.674	-0.563	-0.111	-0.037	-0.052	-0.023	-0.602	-0.567
446.00	-03.505	-12.995	-0.698	-0.115	-0.035	-0.049	-0.022	-0.612	-0.103
456.00	-04.575	-13.384	-0.431	-0.105	-0.039	-0.053	-0.012	-0.619	-0.427
466.00	-05.681	-13.740	-0.357	-0.113	-0.034	-0.046	-0.018	-0.633	-0.352
476.00	-06.626	-14.076	-0.113	-0.114	-0.033	-0.047	-0.016	-0.641	-0.117
476.25	-06.848	-14.085	-0.125	-0.114	-0.034	-0.047	-0.017	-0.641	-0.128
486.00	-07.974	-14.514	-0.595	-0.108	-0.020	-0.046	-0.008	-0.670	-0.596
496.00	-09.022	-14.750	-0.816	-0.099	-0.035	-0.043	-0.004	-0.651	-0.814
506.00	-09.037	-15.148	-0.406	-0.108	-0.040	-0.037	-0.006	-0.658	-0.407
516.00	-09.125	-15.550	-0.042	-0.115	-0.026	-0.032	-0.021	-0.684	-0.048
526.00	-09.231	-15.873	-0.258	-0.114	-0.033	-0.032	-0.009	-0.684	-0.255
536.00	-09.473	-16.166	-0.559	-0.119	-0.026	-0.028	-0.015	-0.700	-0.554
546.00	-09.682	-16.395	-0.473	-0.122	-0.021	-0.059	-0.015	-0.712	-0.468
556.00	-09.614	-16.452	-0.179	-0.143	-0.008	-0.071	-0.033	-0.731	-0.189
566.00	-09.726	-16.731	-0.788	-0.152	-0.064	-0.040	-0.025	-0.672	-0.779
576.00	-09.628	-17.323	-0.950	-0.080	-0.130	-0.125	-0.548	-0.645	-1.115
586.00	-09.774	-17.380	-0.248	-0.115	-0.011	-0.067	-0.144	-0.760	-0.204
596.00	-09.636	-17.246	-0.707	-0.060	-0.001	-0.005	-0.127	-0.772	-0.567
596.11	-09.637	-17.247	-0.712	-0.060	-0.001	-0.005	-0.127	-0.773	-0.672
606.00	-09.635	-17.256	-0.759	-0.061	-0.001	-0.005	-0.126	-0.781	-0.719
616.11	-09.635	-17.257	-0.764	-0.061	-0.001	-0.005	-0.125	-0.783	-0.726

APPENDIX C

**TRAJECTORY LISTING FOR A
TYPICAL PLANAR CASE
METRIC UNITS**

TABLE 1C

APOLLO SOYUZ TEST PROJECT
S-IB STAGE END CONDITIONS OF FLIGHT
TYPICAL PLANAR CASE

Flight Time: OECO + 1.379 seconds	143.00	(sec)
Radius:	6432144.	(m)
Altitude:	58995	(m)
Space Fixed Velocity:	2309.53	(m/s)
Space Fixed Path Angle:	66.098	(deg)
Space Fixed Flight Azimuth:	51.349	(deg)
Earth Fixed Flight Azimuth:	43.199	(deg)
Geocentric Declination:	28.909	(deg)
Geodetic Latitude:	29.072	(deg)
Longitude: (Pos. East)	-80.145	(deg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	6431079.	(m)
Ys =	60569.	(m)
Zs =	100179.	(m)
Xs =	900.30	(m/s)
Ys =	298.76	(m/s)
Zs =	2105.74	(m/s)

VEHICLE ATTITUDE AND ATTITUDE RATE

Pitch Attitude Angle	=	-63.757	(deg)
Yaw Attitude Angle	=	-0.062	(deg)
Roll Attitude Angle	=	0.005	(deg)
Pitch Rate	=	-0.009	(deg/s)
Yaw Rate	=	0.016	(deg/s)
Roll Rate	=	0.004	(deg/s)

TABLE 2C

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL PLANAR CASE

Flight Time: Guidance Cutoff Signal	589.40	(sec)
Radius:	6528187.	(m)
Altitude:	158688.	(m)
Space Fixed Velocity:	7816.64	(m/s)
Space Fixed Flight Path Angle:	90.009	(deg)
Space Fixed Flight Azimuth:	53.621	(deg)
Earth Fixed Flight Azimuth:	51.961	(deg)
Geocentric Declination:	39.472	(deg)
Geodetic Latitude:	39.661	(deg)
Longitude: (Pos. East)	-66.350	(deg)
Inclination:	51.574	(deg)
Descending Node Argument:	156.014	(deg)
Inertial Range Angle:	17.706	(deg)
Mass:	30939.	(kg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	6222693.	(m)
Ys =	161016.	(m)
Zs =	1967077.	(m)
Xs =	-2360.11	(m/s)
Ys =	137.02	(m/s)
Zs =	7450.56	(m/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle =	-99.564	(deg)
Yaw Attitude Angle =	-0.129	(deg)
Roll Attitude Angle =	-0.035	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude =	149.77	(km)
*Apogee Altitude =	159.07	(km)
Eccentricity =	.00071	
Semi-Major Axis =	6532.58	(km)
True Anomaly =	346.45	(deg)
Period =	87.58	(min)

* Referenced to Equatorial Radius (6378.16 km)

TABLE 2C (CONTINUED)

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL PLANAR CASE

Flight Time: Orbit Insertion	599.40	(sec)
Radius:	6528185.	(m)
Altitude:	158836.	(m)
Space Fixed Velocity:	7823.95	(m/s)
Space Fixed Flight Path Angle:	90.000	(deg)
Space Fixed Flight Azimuth:	54.081	(deg)
Earth Fixed Flight Azimuth:	52.450	(deg)
Geocentric Declination:	-39.877	(deg)
Geodetic Latitude:	40.066	(deg)
Longitude: (Pos. East)	-65.671	(deg)
Inclination:	51.575	(deg)
Descending Node Argument:	156.015	(deg)
Inertial Range Angle:	18.392	(deg)
Mass:	30865.	(kg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	6198634.	(m)
Ys =	162375.	(m)
Zs =	2041511.	(m)
Xs =	-2450.29	(m/s)
Ys =	134.75	(m/s)
Zs =	7429.14	(m/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle =	-99.564	(deg)
Yaw Attitude Angle =	-0.135	(deg)
Roll Attitude Angle =	-0.218	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude =	150.02	(km)
*Apogee Altitude =	183.34	(km)
Eccentricity =	.00255	
Semi-Major Axis =	6544.84	(km)
True Anomaly =	0.094	(deg)
Period =	87.82	(min)

* Referenced to Equatorial Radius (6378.16 km)

TABLE 3C
APOLLO SOYUZ TEST PROJECT
SEQUENCE OF EVENTS
TYPICAL PLANAR CASE

FLIGHT TIME (SEC)	PROGRAM TIME (SEC)	
-17.20	---	Guidance Reference Release (GRR)
0.00	---	First Motion
0.20	(0.00) ₁	Lift-off Signal; Initiate Time Base One
59.70	---	Mach One
74.39	---	Maximum Dynamic Pressure
132.00	(131.80) ₁	Tilt Arrest
135.62	(0.00) ₂	Level Sensor Activation; Initiate Time Base Two
138.62	(3.00) ₂	Inboard Engine Cutoff (IECO)
141.62	(0.00) ₃	Outboard Engine Cutoff (OECO); Initiate Time Base Three
142.72	(1.10) ₃	Ignite Ullage Rockets
142.92	(1.30) ₃	Separation Signal
143.00	---	S-IB/S-IVB Physical Separation
144.32	(2.70) ₃	S-IVB J-2 Engine Start Command
147.72	---	90 Percent J-2 Thrust Level
150.72	---	Termination of Ullage Burn
154.92	(13.30) ₃	Jettison Ullage Rockets
166.32	---	Dynamic Pressure = 1 PSF
166.62	---	LES Jettison
171.75	(30.00) ₃	IGM Initiation
469.72	(328.10) ₃	EMR Shift Command
589.40	---	Guidance Cutoff Signal (GCS)
589.60	(0.00) ₄	Inertial Attitude Freeze; Initiate Time Base Four
599.40	---	Orbit Insertion (OI)

TABLE 4C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-IB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC2)	DYNAMIC PRESSURE (N/M2)	A.M.I. (KG-M/M2-RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1) -17.20	594674.0	0.	0.	0.000	0.	0.	0.00	N/A
2) -30	588243.	7132169.	262.	12.145	1.	0.	0.00	N/A
10.00	559814.	7344526.	11424.	13.120	510.	2383.	0.9	-1.764
20.00	531215.	7457508.	44008.	13.976	2499.	49140.	0.20	-1.350
30.00	502474.	7561081.	94688.	14.878	6574.	315091.	0.33	-0.598
40.00	473691.	7680436.	154764.	15.906	12901.	1224977.	0.51	0.01
50.00	444882.	7821190.	240484.	17.057	20828.	3518143.	0.73	0.217
3) 59.70	416938.	7944985.	658466.	17.492	28216.	8129552.	1.00	0.287
60.00	416079.	7948246.	672430.	17.502	26391.	8307465.	1.01	0.280
70.00	387128.	8082215.	657518.	19.192	32594.	15716239.	1.36	0.064
4) 74.39	374421.	8134208.	572761.	20.206	33173.	19876325.	1.56	-0.057
80.00	358161.	8187058.	480872.	21.520	32103.	25870968.	1.86	0.067
90.00	329300.	8244755.	314492.	24.082	24282.	37230821.	2.40	-0.233
100.00	300560.	8261615.	173359.	26.911	15249.	47182780.	2.94	-0.510
110.00	271886.	8249361.	87481.	30.022	8540.	54635824.	3.55	-1.313
120.00	243314.	8215092.	24338.	33.667	4369.	59617471.	4.22	-2.116
130.00	214892.	8161847.	-4857.	38.008	2152.	62700412.	5.01	-3.079
5) 132.00	209239.	8147194.	-7771.	38.979	1868.	63155083.	5.20	-3.274
6) 135.62	199002.	8116482.	-14019.	40.859	1465.	63874557.	5.64	-2.555
7) 138.62	190566.	8078694.	-21650.	42.508	1182.	64394289.	6.04	-1.655
140.00	188213.	4128249.	-21407.	22.048	1041.	64593725.	6.17	-1.314
8) 141.62	185432.	3572512.	-22208.	19.386	692.	64860045.	6.32	-0.826
9) 142.72	184799.	247075.	-20545.	1.448	788.	65010546.	6.36	-0.544
10) 142.92	184684.	255664.	-20135.	1.493	769.	65031118.	6.37	-0.498
11) 143.00	184671.	242845.	-19983.	1.423	762.	65038705.	6.37	-0.481

- 1) Guidance Reference Release
- 2) First Motion
- 3) Mach One
- 4) Maximum Dynamic Pressure
- 5) Tilt Arrest
- 6) LSA, Initiate Time Base Two
- 7) IECG
- 8) OECO, Initiate Time Base Three
- 9) Ignite Ullage Rockets
- 10) Separation Signal
- 11) S-IB/S-IVB Physical Separation

TABLE SC
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
-17.20	6373379.	408.57	90.000	6373353.	12231.	-13162.	0.00	299.29	278.12	
0.00	6373379.	408.57	90.000	6373349.	17377.	-8377.	-0.45	299.12	278.30	
10.00	6373520.	409.52	85.853	6373485.	20367.	-5593.	28.91	298.92	278.41	
20.00	6373996.	416.21	80.732	6373952.	23356.	-2799.	66.06	298.79	282.13	
30.00	6374887.	435.26	75.010	6374833.	26343.	84.	111.34	298.75	296.31	
40.00	6376275.	470.17	69.294	6376206.	29334.	3168.	164.70	299.62	322.74	
50.00	6378238.	524.18	64.249	6378153.	32339.	6590.	225.84	301.37	364.61	
59.78	6380760.	595.21	60.631	6380654.	35270.	10396.	289.55	302.78	422.80	
60.00	6380048.	597.00	60.551	6380741.	35361.	10523.	291.44	302.82	424.84	
70.00	6384109.	689.14	58.522	6383976.	38399.	15149.	356.82	305.05	504.51	
74.39	6385757.	738.14	57.943	6385610.	39739.	17456.	388.39	305.78	548.19	
80.00	6388077.	809.43	57.488	6387909.	41458.	20710.	431.09	306.54	612.68	
91	90.00	6392830.	961.45	57.549	6392616.	44521.	27517.	510.54	305.64	755.19
100.00	6398400.	1148.70	58.587	6398122.	47571.	35947.	591.20	304.58	936.60	
110.00	6404817.	1371.97	60.051	6404449.	50613.	46376.	674.20	303.91	1155.60	
120.00	6412104.	1634.60	61.796	6411606.	53648.	59202.	756.97	302.98	1416.73	
130.00	6420268.	1942.09	63.710	6419582.	56670.	74875.	837.47	301.30	1726.15	
132.00	6422004.	2009.59	64.106	6421273.	57273.	78396.	853.12	300.87	1794.47	
135.62	6425246.	2137.48	64.808	6424417.	58362.	85134.	881.71	300.04	1923.90	
138.62	6428019.	2249.00	65.313	6427101.	59261.	91074.	907.84	299.32	2035.74	
140.00	6429315.	2279.76	65.551	6428353.	59672.	93898.	910.70	299.08	2068.45	
141.62	6430850.	2307.87	65.833	6429833.	60158.	97286.	910.42	298.86	2099.54	
142.72	6431886.	2310.20	66.044	6430831.	60487.	99600.	902.77	298.78	2105.41	
142.92	6432074.	2309.72	66.083	6431011.	60546.	100021.	900.98	298.77	2105.65	
143.00	6432144.	2309.53	66.098	6431079.	60569.	100179.	900.30	298.76	2105.74	

TABLE 6C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----						
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
17.20	90.	.00	N/A	90.	0.	0.	.00	.00	.00	.00
0.00	90.	.00	N/A	90.	0.	0.	.00	.00	.00	.00
10.00	231.	29.62	.400	231.	-1.	-0.	29.62	.015	.003	
20.00	707.	67.13	3.012	707.	-3.	9.	67.04	.028	.348	
30.00	1602.	113.95	8.905	1599.	-6.	104.	112.62	.037	.1740	
40.00	3013.	171.92	14.766	2987.	-7.	398.	166.33	.041	.4348	
50.00	5057.	243.21	20.545	4952.	5.	1025.	227.90	.002	.8491	
59.70	7769.	325.10	26.015	7476.	31.	2115.	292.15	.030	.14257	
60.00	7865.	327.70	26.286	7563.	32.	2158.	294.06	.034	.14459	
70.00	11535.	423.97	31.925	10827.	76.	3978.	360.16	.046	.22363	
74.39	13461.	474.41	34.329	12477.	101.	5052.	392.11	.016	.26699	
80.00	16256.	546.98	37.309	14799.	138.	6726.	435.38	.090	.33104	
90.00	22298.	699.85	42.510	19555.	204.	10713.	516.07	.005	.47268	
100.00	29956.	885.79	47.076	25124.	260.	16313.	598.37	.024	.65310	
110.00	39569.	1107.14	51.783	31533.	311.	23901.	683.46	.005	.87099	
120.00	51504.	1367.52	55.604	38775.	361.	33875.	768.87	.093	.113090	
130.00	66179.	1672.66	59.052	46905.	409.	46684.	852.66	.048	.143901	
132.00	69483.	1739.68	59.704	48627.	417.	49630.	869.06	.035	.150705	
135.62	75813.	1866.76	60.832	51832.	433.	55326.	899.09	.013	.163598	
138.62	81462.	1977.80	61.645	54570.	445.	60400.	926.49	.095	.174737	
140.00	84063.	2008.17	61.975	55848.	450.	62829.	929.82	.093	.177994	
141.62	87252.	2035.76	62.347	57359.	457.	65747.	930.05	.098	.181088	
142.72	89429.	2037.57	62.589	58379.	461.	67744.	922.65	.003	.181670	
142.92	89824.	2036.99	62.633	58563.	462.	68107.	920.89	.004	.181694	
143.00	89973.	2036.77	62.649	58632.	462.	68243.	920.23	.005	.181702	

TABLE 7C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)	
-17.20	0.000	0.000	.00	90.000	- N/A.	-80.621	28.466	28.627	
0.00	0.90	0.000	1.19	90.000	N/A	-80.621	28.466	28.627	
10.00	0.231	0.001	29.65	89.978	39.356	-80.621	28.466	28.627	
20.00	0.707	0.011	67.11	89.591	36.407	-80.621	28.466	28.627	
30.00	1.599	0.108	113.62	88.186	41.013	-80.620	28.467	28.628	
40.00	2.987	0.404	170.61	85.823	43.021	-80.618	28.469	28.630	
50.00	4.952	1.034	239.80	82.524	43.968	-80.614	28.473	28.634	
59.70	7.476	2.128	318.39	78.595	44.006	-80.606	28.480	28.641	
60.00	7.564	2.171	320.85	78.428	44.003	-80.606	28.480	28.642	
70.00	10.829	3.994	412.10	74.110	44.131	-80.593	28.492	28.653	
74.37	12.479	5.069	460.25	72.107	44.074	-80.585	28.499	28.650	
83	80.00	14.802	6.742	533.12	69.539	43.969	-80.573	28.509	28.671
90.00	19.564	10.722	695.01	65.009	43.548	-80.545	28.535	28.697	
100.00	25.145	16.302	879.50	61.010	43.313	-80.506	28.572	28.734	
110.00	31.578	23.850	1090.40	57.779	43.225	-80.453	28.621	28.783	
120.00	38.885	33.751	1344.45	55.170	43.187	-80.383	28.686	28.848	
130.00	47.075	46.439	1651.29	53.066	43.168	-80.294	28.769	28.932	
132.00	48.819	49.354	1719.84	52.698	43.167	-80.274	28.788	28.951	
135.62	52.070	54.986	1848.11	52.073	43.168	-80.234	28.825	28.988	
138.62	54.854	59.999	1957.87	51.598	43.172	-80.199	28.858	29.021	
140.00	56.155	62.397	1986.68	51.473	43.178	-80.182	28.874	29.037	
141.62	57.696	65.277	2017.47	51.302	43.189	-80.162	28.893	29.056	
142.72	58.736	67.247	2020.04	51.348	43.197	-80.148	28.906	29.069	
142.92	58.925	67.606	2019.45	51.348	43.199	-80.146	28.908	29.071	
143.00	58.995	67.740	2019.24	51.349	43.199	-80.145	28.909	29.072	

TABLE 8C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
-17.20	.000	.000	-47.100	-.002	.003	.002	.000	.000	.000
0.00	-.043	.046	-47.066	-.002	.003	.002	-.043	.046	.034
16.00	-.024	-.007	-47.100	-.000	.001	.000	-.011	-.022	.000
20.00	-3.512	-.000	-38.532	-.408	-.000	1.004	.255	.201	.932
30.00	-7.731	.023	-28.530	-.446	.006	1.000	.316	.197	.930
40.00	-12.381	.030	-18.530	-.496	-.008	1.000	.422	.168	.930
50.00	-17.791	-.184	-8.534	-.552	-.028	.999	.454	-.120	.934
59.70	-23.244	-.605	.093	-.562	-.011	.004	.341	-.605	.091
60.00	-23.412	-.609	.086	-.563	-.013	-.047	.341	-.609	.084
70.00	-29.144	-.774	.001	-.595	-.048	-.006	.453	-.774	.002
74.39	-31.785	-.790	.005	-.597	.028	.001	.536	-.790	.002
80.00	-35.385	-.614	.001	-.675	.032	-.002	.669	-.616	-.002
90.00	-42.552	-.096	.002	-.766	.043	.003	.654	-.096	.001
100.00	-47.929	-.008	.009	-.501	-.003	.001	.438	-.008	.009
110.00	-52.816	-.036	.017	-.495	.003	.000	.442	-.036	.017
120.00	-57.565	-.063	.014	-.468	-.002	.000	.445	-.063	.013
130.00	-62.348	-.162	.010	-.469	-.002	-.000	.405	-.162	.009
132.00	-63.287	-.167	.009	-.470	-.003	-.000	.425	-.167	.008
135.62	-63.819	-.171	.007	-.058	-.001	-.003	-.107	-.171	.007
138.62	-63.792	-.170	.005	-.012	.002	-.000	-.080	-.170	.005
140.00	-63.789	-.126	.004	-.016	.055	-.001	-.077	-.126	.004
141.62	-63.761	-.075	.003	-.015	.009	-.001	-.049	-.075	.003
142.72	-63.755	-.066	.004	-.005	.013	.003	-.043	-.066	.004
142.92	-63.756	-.063	.004	-.008	.015	.004	-.044	-.063	.004
143.00	-63.757	-.062	.005	-.009	.016	.004	-.045	-.062	.005

TABLE 9C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S ²)	DYNAMIC PRESSURE (N/M ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
1)	143.00	138804.	40075.	3329.	.265	762.	-63.712	-4.480
2)	144.32	138804.	39965.	2861.	.268	651.	-63.712	-2.220
3)	147.72	138502.	604088.	2029.	5.792	430.	-63.712	-1.05
4)	150.72	137848.	866856.	1436.	6.279	306.	-63.712	1.136
5)	154.92	136830.	1019172.	883.	7.442	188.	-63.712	2.466
	160.00	135533.	1019337.	512.	7.518	103.	-63.712	3.519
6)	166.31	130978.	1019765.	266.	7.784	48.	-63.712	4.892
7)	166.62	130641.	1019713.	251.	7.804	46.	-63.712	4.960
	170.00	128891.	1021335.	175.	7.923	30.	-63.712	5.664
8)	171.75	128461.	1026181.	144.	7.987	24.	-63.712	6.048
	180.00	126432.	1023228.	107.	8.093	8.	-55.824	14.468
	190.00	123974.	1023368.	36.	8.255	2.	-56.432	16.774
	200.00	121518.	1023438.	12.	8.422	1.	-57.575	17.398
	210.00	119065.	1021221.	5.	8.577	0.	-58.556	18.008
	220.00	116614.	1020447.	2.	8.751	0.	-59.664	18.460
	230.00	114168.	1018423.	1.	8.920	0.	-60.616	19.043
	240.00	111721.	1017984.	1.	9.112	0.	-61.780	19.371
	250.00	109280.	1016538.	0.	9.302	0.	-62.737	19.769
	260.00	106838.	1016512.	0.	9.514	0.	-63.815	20.027
	270.00	104390.	1017894.	0.	9.751	0.	-65.106	19.965
	280.00	101944.	1018571.	0.	9.991	0.	-66.145	20.174
	290.00	99494.	1017727.	0.	10.229	0.	-67.304	20.185
	300.00	97046.	1016660.	0.	10.476	0.	-68.426	20.176
	310.00	94602.	1017254.	0.	10.753	0.	-69.414	20.270
	320.00	92159.	1016515.	0.	11.030	0.	-70.538	20.160
	330.00	89716.	1017338.	0.	11.339	0.	-71.588	20.058
	340.00	87266.	1018955.	0.	11.676	0.	-72.917	19.693
	350.00	84817.	1017470.	0.	11.996	0.	-73.996	19.400
	360.00	82372.	1016661.	0.	12.342	0.	-75.003	19.243
	370.00	79927.	1015560.	0.	12.706	0.	-76.084	18.978
	380.00	77477.	1018962.	0.	13.152	0.	-77.261	18.609
	390.00	75029.	1013965.	0.	13.514	0.	-78.392	18.162
	400.00	72587.	1013822.	0.	13.967	0.	-79.378	17.921
	410.00	70144.	1013540.	0.	14.449	0.	-80.529	17.448
	420.00	67702.	1013301.	0.	14.967	0.	-81.677	16.950

- 1) S-IB/S-IVB Separation
- 2) S-IVB Start Command
- 3) J-2 90 Percent Thrust
- 4) Termination of Ullage Burn
- 5) Jettison Ullage Rockets
- 6) Dynamic Pressure = 1 PSF
- 7) LES Jettison
- 8) IGM Initiation

TABLE 9C (Continued)
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S ²)	DYNAMIC PRESSURE (N/M ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
430.00	65259.	1016529.	0.	15.577	0.	9.148	-82.818	16.436
440.00	62809.	1017444.	0.	16.199	0.	9.570	-84.044	15.806
450.00	60364.	1013580.	0.	16.791	0.	10.006	-85.126	15.278
460.00	57920.	1013339.	0.	17.495	0.	10.456	-86.244	14.703
470.00	55522.	1012726.	0.	18.246	0.	10.921	-87.380	14.084
9)	470.25	55466.	912754.	0.	16.456	0.	-87.409	14.069
480.00	53415.	858999.	0.	16.081	0.	11.400	-88.515	13.538
490.00	51360.	858864.	0.	16.722	0.	11.894	-89.556	13.070
500.00	49306.	858732.	0.	17.416	0.	12.401	-90.591	12.605
510.00	47252.	858559.	0.	18.169	0.	12.924	-91.689	12.054
520.00	45199.	858380.	0.	18.991	0.	13.463	-92.845	11.391
530.00	43145.	858179.	0.	19.896	0.	14.018	-93.981	10.748
540.00	41092.	857962.	0.	20.879	0.	14.590	-95.147	10.085
550.00	39032.	861875.	0.	22.081	0.	15.181	-96.446	9.297
560.00	36973.	858674.	0.	23.224	0.	15.791	-97.609	8.566
570.00	34919.	858237.	0.	24.577	0.	16.421	-99.698	6.790
580.00	32867.	857623.	0.	26.093	0.	17.073	-99.529	7.460
10)	589.40	30939.	856777.	0.	27.692	0.	-99.437	7.960
590.00	30885.	52920.	0.	1.713	0.	17.748	-99.437	7.944
11)	599.40	30865.	0.	4.	0.	18.393	-99.564	8.634

9) EMR Shift
10) Guidance Cutoff Signal
11) Orbit Insertion

TABLE 10C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
143.00	6432151.	2309.52	66.099	6431085.	60570.	100193.	700.27	298.76	2105.74	
144.32	6433379.	2304.73	66.363	6432266.	60965.	102975.	887.69	298.66	2105.84	
147.72	6436471.	2296.85	67.040	6435230.	61780.	110137.	857.18	298.57	2109.89	
150.72	6439131.	2304.01	67.611	6437770.	62876.	116491.	836.39	298.91	2125.93	
154.92	6442768.	2319.41	68.379	6441227.	64131.	125476.	809.90	298.61	2152.80	
160.00	6447036.	2339.18	69.288	6445257.	65645.	136485.	778.23	297.85	2185.73	
166.31	6452154.	2365.54	70.389	6450047.	67523.	150416.	739.16	296.93	2227.39	
166.62	6452400.	2366.92	70.442	6450276.	67615.	151109.	737.26	296.88	2229.49	
170.00	6455045.	2382.30	71.014	6452730.	68616.	158672.	716.79	296.30	2252.50	
171.75	6456394.	2390.52	71.306	6453975.	69134.	162624.	706.24	295.99	2264.55	
180.00	6462548.	2429.96	72.580	6459601.	71567.	181540.	659.33	293.23	2320.35	
190.00	6469628.	2478.68	73.870	6465948.	74479.	205065.	610.06	289.29	2384.95	
200.00	6476322.	2530.91	75.111	6471801.	77352.	229246.	560.50	285.32	2451.52	
210.00	6482635.	2586.51	76.305	6477157.	80186.	254102.	510.56	281.44	2519.95	
220.00	6488572.	2645.54	77.443	6482012.	82982.	279651.	460.43	277.78	2590.32	
230.00	6494140.	2707.82	78.530	6486364.	85742.	305914.	409.91	274.28	2662.53	
240.00	6499345.	2773.51	79.561	6490210.	88468.	332909.	359.18	270.86	2736.78	
250.00	6504192.	2842.51	80.542	6493546.	91160.	360656.	307.87	267.52	2813.09	
260.00	6508690.	2914.86	81.468	6496367.	93818.	389177.	256.22	264.19	2891.54	
270.00	6512844.	2991.03	82.345	6498669.	96443.	418496.	204.02	260.89	2972.64	
280.00	6516661.	3070.69	83.173	6500445.	99036.	448638.	151.06	257.61	3056.14	
290.00	6520147.	3154.03	83.952	6501689.	101596.	479628.	97.50	254.31	3142.25	
300.00	6523311.	3241.04	84.682	6502393.	104122.	511492.	43.18	250.99	3231.02	
310.00	6526158.	3331.58	85.365	6502550.	106615.	544257.	-11.92	247.62	3322.34	
320.00	6528699.	3425.88	85.999	6502152.	10974.	577948.	-67.78	244.20	3416.49	
330.00	6530941.	3523.93	86.590	6501191.	111499.	612596.	-124.60	240.75	3513.49	
340.00	6532896.	3626.38	87.133	6499658.	113889.	648231.	-182.31	237.24	3614.01	
350.00	6534571.	3733.01	87.640	6497540.	116244.	684887.	-241.50	233.74	3717.85	
360.00	6535974.	3843.74	88.105	6494825.	118564.	722599.	-301.83	230.16	3824.95	
370.00	6537118.	3958.75	88.526	6491500.	120847.	761398.	-363.30	226.52	3935.53	
380.00	6538015.	4078.49	88.907	6487555.	123094.	801322.	-426.07	222.82	4050.05	
390.00	6538677.	4203.12	89.252	6482973.	125303.	842413.	-490.57	219.10	4166.64	
400.00	6539118.	4332.28	89.558	6477739.	127475.	884708.	-556.53	215.29	4290.99	
410.00	6539352.	4466.71	89.825	6471838.	129609.	928248.	-624.09	211.42	4417.84	
420.00	6539396.	4606.72	90.057	6465251.	131704.	973081.	-693.60	207.51	4549.48	

TABLE 10 C (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
430.00	6539266.0	4752.70	90+254	6457959.	133759.	1019255.	7765.19	203.54	4686.28
440.00	6538982.	4945.52	90+416	6449940.	135774.	1066827.	-839.67	199.53	4829.11
450.00	6538560.	5064.70	90+547	6441169.	137750.	1115855.	-915.54	195.49	4977.43
460.00	6538023.	5230.93	90+643	6431621.	139684.	1166397.	-994.52	191.38	5131.95
470.00	6537395.	5404.86	90+706	6421269.	141577.	1218518.	-1076.37	187.21	5293.28
470.25	6537378.	5409.17	90+707	6421000.	141624.	1219842.	-1078.47	187.11	5297.27
480.00	6536669.	5559.67	90+808	6410078.	143430.	1272151.	-1162.39	183.34	5433.70
490.00	6535836.	5720.41	90+881	6396013.	145244.	1327211.	-1251.20	179.41	5579.01
500.00	6534920.	5888.05	90+922	6385045.	147018.	1383752.	-1342.80	175.38	5730.20
510.00	6533952.	6063.13	90+932	6371146.	148751.	1441836.	-1437.55	171.27	5887.76
520.00	6532959.	6246.32	90+913	6356282.	150443.	1501531.	-1535.99	167.11	6052.22
530.00	6531971.	6438.30	90+866	6340413.	152093.	1562907.	-1638.47	162.92	6224.20
540.00	6531023.	6639.88	90+791	6323498.	153701.	1626043.	-1745.43	158.69	6404.40
550.00	6530150.	6852.81	90+688	6305488.	155267.	1691029.	-1857.51	154.46	6594.45
560.00	6529390.	7077.45	90+560	6286327.	156790.	1757966.	-1975.63	150.27	6794.46
570.00	6528782.	7314.66	90+413	6265954.	158271.	1826955.	-2101.08	145.89	7004.89
580.00	6528350.	7566.27	90+240	6244281.	159708.	1898107.	-2233.82	141.34	7227.62
589.40	6528187.	7816.64	90+009	6222693.	161016.	1967077.	-2360.11	137.02	7450.56
590.00	6528186.	7823.09	90+003	6221274.	161098.	1971550.	-2366.55	136.83	7455.30
599.40	6528185.	7823.95	90+000	6198634.	162375.	2041511.	-2450.29	134.75	7429.14

TABLE 11C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
143.00	89987.	2036.75	62.650	58639.	462.	68256.	920.20	4.05	1817.03
144.32	92597.	2031.27	62.940	59846.	468.	70657.	907.86	4.11	1817.10
147.72	99288.	2021.68	63.692	62880.	482.	76837.	878.01	4.46	1821.06
150.72	105193.	2027.45	64.351	65484.	497.	82324.	857.90	5.22	1836.99
154.92	113503.	2041.15	65.248	69033.	520.	90095.	832.40	5.54	1863.70
160.00	123625.	2059.05	66.310	73180.	548.	99636.	801.94	5.58	1896.46
166.31	136345.	2083.25	67.597	78125.	583.	111741.	764.42	5.69	1937.93
166.62	136974.	2084.53	67.660	78362.	585.	112343.	762.60	5.69	1940.02
170.00	143839.	2098.86	68.329	80902.	604.	118929.	742.98	6.70	1962.94
171.75	147417.	2106.55	68.671	82194.	614.	122375.	732.88	5.69	1974.95
180.00	164458.	2143.97	70.166	88048.	658.	138901.	688.07	4.43	2030.55
190.00	185517.	2190.92	71.681	94696.	692.	159527.	641.40	2.33	2094.93
200.00	207044.	2241.63	73.036	100676.	705.	180806.	594.55	3.35	2161.34
210.00	229069.	2295.90	74.530	106586.	700.	202760.	547.41	-1.38	2229.60
220.00	251621.	2353.79	75.856	111624.	679.	225407.	500.20	-2.72	2300.02
230.00	274733.	2415.09	77.117	116589.	646.	248767.	452.71	-3.76	2372.27
240.00	298436.	2479.96	78.308	120878.	605.	272859.	405.12	-4.54	2446.64
250.00	322764.	2548.27	79.438	124689.	556.	297706.	357.07	-5.07	2523.13
260.00	347751.	2620.09	80.500	128019.	504.	323329.	308.81	-5.41	2601.82
270.00	373434.	2695.83	81.500	130865.	449.	349752.	260.14	-5.53	2683.24
280.00	399848.	2775.17	82.442	133220.	394.	377002.	210.84	-5.45	2767.14
290.00	427032.	2858.27	83.323	135681.	341.	405104.	161.09	-5.19	2853.72
300.00	455024.	2945.13	84.146	136441.	291.	434086.	110.73	-4.75	2943.04
310.00	483861.	3035.58	84.912	137293.	246.	463974.	59.74	-4.15	3034.99
320.00	513581.	3129.87	85.620	137634.	208.	494795.	8.16	-3.37	3129.85
330.00	544225.	3227.95	86.276	137454.	179.	526580.	-44.23	-2.42	3227.64
340.00	575034.	3330.46	86.878	136748.	160.	559361.	-97.31	-1.27	3329.04
350.00	608453.	3437.20	87.437	135504.	155.	593173.	-151.69	-1.13	3433.85
360.00	642125.	3548.06	87.947	133711.	164.	628049.	-207.02	1.71	3542.01
370.00	676893.	3663.23	88.408	131360.	189.	664025.	-263.30	3.48	3653.75
380.00	712805.	3783.14	88.822	128442.	234.	701137.	-320.64	5.47	3769.52
390.00	749911.	3907.95	89.195	124943.	300.	739430.	-379.50	7.74	3889.48
400.00	788259.	4037.31	89.525	120848.	389.	778940.	-439.59	10.22	4013.29
410.00	827899.	4171.94	89.813	116147.	505.	819711.	-501.03	12.95	4191.72
420.00	868887.	4312.14	90.061	110822.	649.	861791.	-564.17	15.97	4275.05

TABLE 11C (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 5+4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
430.00	911283.	4458.32	90+271	104857.	825.	905230.	-629.09	19+30	4413.67
440.00	955151.	4611.33	90+443	98234.	1036.	950086.	-696.01	22+97	4558.44
450.00	1000559.	4770.69	90+581	90930.	1286.	996417.	-765.21	27+00	4708.84
460.00	1047573.	4937.10	90+681	82923.	1578.	1044284.	-836.59	31+38	4865.60
470.00	1096268.	5111.19	90+746	74190.	1915.	1093753.	-910.49	36+16	5029.31
470.25	1097508.	5115.51	90+748	73962.	1924.	1095011.	-912.38	36+28	5033.36
480.00	1146589.	5266.13	90+853	64696.	2302.	1144760.	-988.79	41+24	5172.30
490.00	1198457.	5426.99	90+928	54406.	2741.	1197218.	-1069.58	46+69	5320.35
500.00	1251941.	5594.75	90+970	43296.	3237.	1251187.	-1152.83	52+48	5474.44
510.00	1307111.	5769.95	90+979	31341.	3792.	1306730.	-1238.87	58+66	5635.08
520.00	1364046.	5953.24	90+958	18508.	4411.	1363913.	-1328.22	65+32	5802.81
530.00	1422830.	6145.31	90+908	4764.	5100.	1422813.	-1421.21	72+49	5978.28
540.00	1483553.	6346.97	90+828	-9929.	5863.	1483508.	-1518.23	80+22	6162.19
550.00	1546318.	6559.97	90+718	-25616.	6707.	1546092.	-1619.88	88+62	6356.20
560.00	1611242.	6784.66	90+584	-42346.	7638.	1610667.	-1727.04	97+77	6560.44
570.00	1678440.	7021.91	90+431	-60176.	8664.	1677338.	-1840.99	107+51	6775.43
580.00	1748041.	7273.55	90+250	-79188.	9791.	1746219.	-1961.60	117+94	7003.05
589.40	1815790.	7523.93	90+010	-98162.	10948.	1813102.	-2075.86	128+41	7230.76
590.00	1820193.	7530.38	90+003	-99409.	11025.	1817443.	-2081.77	128+93	7235.76
599.40	1889172.	7531.14	90+000	-119346.	12268.	1885359.	-2159.97	135+47	7213.48

TABLE 19C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
143.00	59.002	67.753	2019.23	51.349	43.199	-80.145	28.909	29.072
144.32	60.235	70.121	2014.40	51.359	43.210	-80.128	28.925	29.088
147.72	63.340	76.213	1990.91	51.375	43.244	-80.085	28.964	29.128
150.72	66.011	81.618	1996.46	51.353	43.286	-80.047	29.000	29.163
154.92	69.664	89.267	2009.87	51.208	43.323	-79.993	29.050	29.213
160.00	73.951	98.649	2027.46	51.201	43.355	-79.927	29.111	29.275
166.31	79.094	110.539	2051.28	51.096	43.399	-79.843	29.189	29.353
166.62	79.342	111.130	2052.54	51.091	43.401	-79.839	29.193	29.357
170.00	82.000	117.593	2066.68	51.034	43.424	-79.793	29.235	29.399
171.75	83.355	120.973	2074.28	51.004	43.435	-79.769	29.257	29.421
180.00	89.543	137.170	2111.32	50.843	43.454	-79.654	29.363	29.527
190.00	96.665	157.356	2157.93	50.657	43.467	-79.511	29.494	29.660
200.00	103.403	178.153	2208.30	50.482	43.489	-79.363	29.630	29.796
210.00	109.761	199.583	2262.27	50.322	43.523	-79.210	29.770	29.936
220.00	115.745	221.665	2319.87	50.179	43.572	-79.052	29.914	30.080
230.00	121.361	244.423	2380.99	50.051	43.633	-78.890	30.062	30.229
240.00	126.615	267.879	2445.50	49.957	43.705	-78.721	30.215	30.382
250.00	131.514	292.055	2513.56	49.835	43.787	-78.547	30.372	30.540
260.00	136.064	316.975	2585.13	49.744	43.877	-78.367	30.533	30.702
270.00	140.273	342.668	2660.64	49.665	43.975	-78.181	30.700	30.869
280.00	144.146	369.160	2739.75	49.596	44.082	-77.988	30.871	31.041
290.00	147.691	396.481	2822.64	49.538	44.195	-77.789	31.047	31.217
300.00	150.914	424.662	2909.28	49.490	44.316	-77.582	31.229	31.399
310.00	153.823	453.731	2999.53	49.453	44.444	-77.368	31.415	31.587
320.00	156.428	483.719	3093.60	49.426	44.578	-77.146	31.608	31.780
330.00	158.737	514.661	3191.47	49.409	44.720	-76.917	31.806	31.978
340.00	160.760	546.590	3293.78	49.402	44.868	-76.678	32.009	32.183
350.00	162.506	579.547	3400.31	49.407	45.025	-76.431	32.219	32.393
360.00	163.982	613.570	3510.95	49.422	45.190	-76.175	32.435	32.609
370.00	165.201	648.697	3625.70	49.447	45.361	-75.908	32.657	32.832
380.00	166.176	684.970	3745.59	49.484	45.541	-75.632	32.886	33.062
390.00	166.919	722.436	3870.18	49.532	45.729	-75.345	33.122	33.298
400.00	167.442	761.140	3999.30	49.592	45.925	-75.046	33.364	33.541
410.00	167.763	801.129	4133.69	49.663	46.131	-74.736	33.614	33.791
420.00	167.896	842.456	4273.64	49.747	46.346	-74.413	33.871	34.049

TABLE 12 C (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	S-4B STAGE FLIGHT DATA			LONGITUDE (POS. EAST)	GEOCENTRIC DECLINATION (DEG)	GEOGRAPHIC LATITUDE (DEG)
			RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED	AZIMUTH (DEG)			
430.00	167.858	885.177	4419.56	49.843	46.571	-74.077	34.136	34.314
440.00	167.668	929.355	4572.30	49.953	46.806	-73.728	34.408	34.588
450.00	167.344	975.056	4731.38	50.076	47.053	-73.363	34.689	34.869
460.00	166.908	1022.344	4897.50	50.213	47.311	-72.983	34.978	35.159
470.00	166.385	1071.294	5071.29	50.366	47.581	-72.586	35.275	35.457
470.25	166.371	1072.540	5075.60	50.370	47.588	-72.576	35.283	35.465
480.00	165.767	1121.055	5225.91	50.547	47.865	-72.174	35.581	35.764
490.00	165.045	1173.954	5386.45	50.742	48.161	-71.744	35.895	36.078
500.00	164.244	1227.661	5553.97	50.951	48.470	-71.298	36.216	36.400
510.00	163.393	1283.044	5728.72	51.176	48.792	-70.834	36.545	36.730
520.00	162.521	1340.181	5911.64	51.416	49.128	-70.350	36.883	37.068
530.00	161.658	1399.156	6103.33	51.674	49.480	-69.846	37.229	37.414
540.00	160.837	1460.059	6304.59	51.950	49.849	-69.321	37.583	37.769
550.00	160.096	1522.990	6517.17	52.246	50.237	-68.772	37.947	38.133
560.00	159.471	1588.065	6741.43	52.562	50.644	-68.198	38.319	38.507
570.00	159.002	1655.398	6978.23	52.900	51.071	-67.598	38.702	38.890
580.00	158.714	1725.120	7229.41	53.261	51.519	-66.969	39.094	39.282
589.40	158.688	1792.957	7479.33	53.621	51.961	-66.350	39.472	39.661
590.00	158.697	1797.364	7485.75	53.647	51.990	-66.309	39.496	39.685
599.40	158.836	1866.432	7486.05	54.081	52.450	-65.671	39.877	40.066

TABLE 13C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
143.00	-63.757	-0.062	-005	-0.009	-0.013	-004	-0.045	-0.062	-005
144.32	-63.817	-0.037	-018	-0.073	-0.146	-016	-0.105	-0.037	-018
147.72	-64.101	-1.135	-026	-0.017	-0.286	-076	-0.388	-1.136	-023
150.72	-63.804	-0.865	-038	-0.159	-0.337	-010	-0.090	-0.866	-038
154.92	-63.451	-0.317	-0035	-0.008	-0.101	-015	-0.261	-0.317	-036
160.00	-63.574	-0.269	-0115	-0.018	-0.020	-006	-0.138	-0.269	-015
166.31	-63.632	-0.346	-0260	-0.006	-0.021	-027	-0.081	-0.346	-020
166.62	-63.634	-0.353	-0253	-0.006	-0.021	-020	-0.079	-0.353	-0253
170.00	-63.657	-0.409	-0293	-0.009	-0.009	-042	-0.056	-0.409	-0294
171.75	-63.675	-0.419	-0391	-0.011	-0.003	-069	-0.039	-0.419	-0391
180.00	-56.946	-1.970	-0363	-0.970	-0.076	-073	-1.122	-0.539	-0397
190.00	-56.388	-1.827	-0560	-0.086	-0.005	-014	-0.046	-0.460	-0561
200.00	-57.455	-1.765	-0742	-0.139	-0.010	-035	-0.123	-0.470	-0745
210.00	-58.484	-1.557	-0352	-0.096	-0.020	-037	-0.074	-0.493	-0354
220.00	-59.609	-1.361	-0035	-0.104	-0.015	-033	-0.056	-0.492	-0036
230.00	-60.544	-1.240	-013	-0.097	-0.011	-033	-0.070	-0.498	-012
240.00	-61.670	-1.124	-005	-0.139	-0.014	-022	-0.108	-0.506	-003
250.00	-62.665	-1.053	-048	-0.097	-0.006	-059	-0.069	-0.506	-047
260.00	-63.727	-0.991	-0034	-0.113	-0.007	-063	-0.087	-0.513	-003
270.00	-65.049	-0.904	-0647	-0.111	-0.005	-062	-0.059	-0.513	-048
280.00	-66.045	-0.873	-0443	-0.108	-0.004	-031	-0.082	-0.523	-044
290.00	-67.225	-0.827	-0154	-0.114	-0.004	-029	-0.080	-0.530	-0155
300.00	-68.355	-0.792	-0143	-0.117	-0.003	-029	-0.070	-0.536	-0143
310.00	-69.331	-0.782	-0482	-0.108	-0.003	-031	-0.080	-0.548	-0482
320.00	-70.460	-0.750	-0779	-0.111	-0.002	-030	-0.075	-0.553	-078
330.00	-71.526	-0.731	-0454	-0.101	-0.001	-050	-0.060	-0.559	-0454
340.00	-72.803	-0.682	-0124	-0.145	-0.007	-063	-0.115	-0.572	-0125
350.00	-73.971	-0.660	-0671	-0.116	-0.001	-054	-0.027	-0.574	-0671
360.00	-74.979	-0.649	-0566	-0.106	-0.001	-021	-0.027	-0.582	-0566
370.00	-76.056	-0.630	-0360	-0.109	-0.002	-020	-0.030	-0.592	-0360
380.00	-77.200	-0.601	-0173	-0.135	-0.006	-013	-0.062	-0.604	-0174
390.00	-78.391	-0.573	-0000	-0.092	-0.001	-025	-0.041	-0.607	-000
400.00	-79.344	-0.571	-0241	-0.112	-0.003	-019	-0.033	-0.622	-0241
410.00	-80.495	-0.542	-0424	-0.116	-0.003	-018	-0.032	-0.630	-0424
420.00	-81.645	-0.516	-0607	-0.114	-0.003	-018	-0.029	-0.640	-0607

TABLE 13 C (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
430.00	-82.784	-0.490	0.791	-0.114	0.002	0.018	0.030	-0.650	0.791
440.00	-84.012	-0.453	0.828	-0.117	0.003	0.054	0.028	-0.660	0.828
450.00	-85.107	-0.431	0.313	-0.107	0.002	0.051	0.017	-0.665	0.312
460.00	-86.224	-0.407	0.212	-0.114	0.003	0.053	0.021	-0.674	-0.212
470.00	-87.364	-0.380	0.744	-0.114	0.003	0.053	0.020	-0.682	-0.744
470.25	-87.392	-0.380	0.750	-0.114	0.003	0.026	0.021	-0.682	-0.750
480.00	-88.506	-0.359	0.339	-0.108	0.002	0.044	0.012	-0.690	-0.339
490.00	-89.554	-0.346	0.107	-0.100	0.000	0.046	0.002	-0.697	-0.107
500.00	-90.577	-0.339	0.558	-0.108	0.002	0.043	0.011	-0.709	0.558
510.00	-91.661	-0.320	0.559	-0.114	0.004	0.061	0.024	-0.719	0.559
520.00	-92.832	-0.291	0.063	-0.112	0.003	0.061	0.013	-0.724	-0.063
530.00	-93.970	-0.262	0.679	-0.116	0.003	0.062	0.015	-0.730	-0.679
540.00	-95.134	-0.229	0.284	-0.117	0.003	0.044	0.015	-0.739	-0.284
550.00	-96.411	-0.173	0.125	-0.139	0.005	0.038	0.034	-0.750	0.125
560.00	-97.625	-0.151	0.547	-0.101	-0.004	0.047	-0.020	-0.747	0.547
570.00	-99.874	-0.178	0.248	0.003	0.003	0.017	-0.178	-0.763	0.247
580.00	-99.674	-0.153	0.113	0.015	0.003	0.015	-0.145	-0.770	0.112
589.40	-99.564	-0.129	0.035	-0.006	-0.001	0.018	-0.127	-0.772	-0.035
590.00	-99.565	-0.130	0.046	-0.006	-0.001	0.018	-0.127	-0.772	-0.046
599.40	-99.564	-0.135	0.218	0.000	-0.000	0.018	-0.125	-0.777	-0.219

TABLE 14C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE MASS CHARACTERISTICS

FLIGHT TIME (SEC)	MASS (KG)	--- CENTER OF GRAVITY ---			--- MOMENT OF INERTIA ---		
		X-AXIS (M)	Y-AXIS (M)	Z-AXIS (M)	X-AXIS (KG-M-S2)	Y-AXIS (KG-M-S2)	Z-AXIS (KG-M-S2)
17.20	594674.	0.0000	0.0000	0.0000	0.	0.	0.
00	588243.	16.3828	0.0069	0.010	216392.	7830578.	7829976.
10.00	559814.	16.2483	0.0074	0.010	203907.	7796576.	7795962.
20.00	538215.	16.1589	0.0079	0.010	191616.	7776914.	7775289.
30.00	502474.	16.1224	0.0084	0.010	179274.	7762985.	7762364.
40.00	473691.	16.1504	0.0089	0.013	166896.	7751054.	7750421.
50.00	444882.	16.2542	0.0094	0.013	154520.	7731616.	7730978.
59.70	416938.	16.4441	0.0099	0.015	142508.	7696911.	7696277.
60.00	416079.	16.4507	0.0099	0.015	142139.	7695669.	7695035.
70.00	387128.	16.7653	0.0107	0.015	129726.	7628167.	7627533.
74.37	374421.	16.9460	0.0112	0.015	124295.	7585393.	7584755.
80.00	358161.	17.2216	0.0117	0.018	117340.	7515844.	7515217.
90.00	329300.	17.8535	0.0127	0.018	104969.	7340178.	7339478.
100.00	300560.	18.7100	0.0140	0.020	92637.	7073936.	7073295.
110.00	271886.	19.8641	0.0155	0.023	80330.	6678646.	6678014.
120.00	243314.	21.4177	0.0173	0.025	68058.	6100917.	6100276.
130.00	214892.	23.5223	0.0196	0.030	55842.	5262466.	5261816.
132.00	209239.	24.0536	0.0201	0.031	53410.	5041401.	5040753.
135.62	199002.	25.0416	0.0210	0.033	49001.	4628444.	4627799.
138.62	190566.	25.9578	0.0221	0.033	45343.	4237918.	4237267.
140.00	188213.	24.2465	0.0223	0.034	44320.	4109512.	4108861.
141.62	185432.	26.5877	0.0226	0.036	43111.	3957759.	3957108.
142.72	184799.	26.6700	0.0226	0.036	42771.	3920294.	3919656.
142.92	184684.	26.6850	0.0226	0.036	42709.	3913482.	3912847.
143.00	184671.	26.6869	0.0226	0.036	42704.	3912541.	3911909.

TABLE 15 C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE MASS CHARACTERISTICS

FLIGHT TIME (SEC)	MASS (KG)	--- CENTER OF GRAVITY ---			--- MOMENT OF INERTIA ---		
		X-AXIS (M)	Y-AXIS (M)	Z-AXIS (M)	X-AXIS (KG-M-S2)	Y-AXIS (KG-M-S2)	Z-AXIS (KG-M-S2)
143.00	138804.	8.1289	-.0257	.0048	14006.	1132613.	1132530.
144.32	138804.	8.1289	-.0257	.0048	14006.	1132613.	1132530.
147.72	138532.	8.1322	-.0257	.0048	13943.	1132250.	1132173.
150.72	137848.	8.1401	-.0258	.0048	13941.	1131817.	1131733.
154.92	136836.	8.1541	-.0259	.0049	13887.	1131023.	1130942.
160.00	135533.	8.1730	-.0260	.0051	13821.	1129976.	1129896.
166.31	130978.	7.5513	-.0271	.0047	13739.	882874.	882790.
166.62	130641.	7.4967	-.0272	.0047	13732.	861533.	861449.
170.00	128891.	7.3088	-.0275	.0046	13707.	785634.	785550.
171.75	128461.	7.3129	-.0276	.0046	13707.	785387.	785303.
180.00	126432.	7.3331	-.0281	.0047	13706.	784222.	784138.
190.00	123974.	7.3605	-.0286	.0048	13705.	782808.	782721.
200.00	121518.	7.3914	-.0291	.0048	13704.	781393.	781307.
210.00	119065.	7.4251	-.0296	.0049	13702.	779903.	779815.
220.00	116614.	7.4623	-.0302	.0051	13701.	778305.	778216.
230.00	114168.	7.5038	-.0308	.0051	13700.	776536.	776446.
240.00	111721.	7.5486	-.0315	.0052	13699.	774685.	774594.
250.00	109280.	7.5977	-.0321	.0053	13698.	772648.	772556.
260.00	106838.	7.6505	-.0329	.0056	13697.	770490.	770404.
270.00	104390.	7.7078	-.0336	.0056	13695.	768221.	768127.
280.00	101944.	7.7708	-.0344	.0057	13694.	765683.	765588.
290.00	99494.	7.8380	-.0352	.0058	13693.	763041.	762945.
300.00	97046.	7.9115	-.0360	.0061	13691.	760097.	760001.
310.00	94632.	7.9897	-.0369	.0061	13690.	757026.	756928.
320.00	92159.	8.0750	-.0378	.0063	13689.	753681.	753581.
330.00	89716.	8.1670	-.0388	.0065	13688.	750039.	749939.
340.00	87266.	8.2659	-.0397	.0066	13686.	746147.	746045.
350.00	84817.	8.3740	-.0411	.0069	13685.	741825.	741722.
360.00	82372.	8.4894	-.0423	.0071	13684.	737288.	737184.
370.00	79927.	8.6143	-.0435	.0072	13682.	732362.	732257.
380.00	77477.	8.7501	-.0448	.0075	13681.	726932.	726827.
390.00	75029.	8.8965	-.0463	.0077	13679.	721115.	721007.
400.00	72587.	9.0559	-.0478	.0080	13678.	714680.	714571.
410.00	70144.	9.2284	-.0494	.0082	13676.	707715.	707604.
420.00	67702.	9.4165	-.0511	.0085	13675.	700078.	699967.

TABLE 15 C (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 S-4B STAGE MASS CHARACTERISTICS

FLIGHT TIME (SEC)	MASS (KG)	--- CENTER OF GRAVITY ---			--- MOMENT OF INERTIA ---		
		X-AXIS (M)	Y-AXIS (M)	Z-AXIS (M)	X-AXIS (KG-M-S2)	Y-AXIS (KG-M-S2)	Z-AXIS (KG-M-S2)
430.00	65259.	9.6218	-.0530	.0088	13673.	691710.	691596.
440.00	62809.	9.8472	-.0551	.0091	13671.	682440.	682324.
450.00	60364.	10.0937	-.0571	.0095	13669.	672229.	672111.
460.00	57920.	10.3642	-.0595	.0099	13668.	660993.	660875.
470.00	55522.	10.6563	-.0620	.0103	13666.	648718.	648599.
470.25	55466.	10.6635	-.0621	.0103	13666.	648415.	648296.
480.00	53415.	10.9354	-.0643	.0108	13664.	636995.	636873.
490.00	51360.	11.2323	-.0669	.0110	13662.	624467.	624344.
500.00	49306.	11.5582	-.0697	.0115	13661.	610406.	610481.
510.00	47252.	11.9151	-.0726	.0121	13659.	595333.	595206.
520.00	45199.	12.3084	-.0759	.0126	13657.	578416.	578288.
530.00	43145.	12.7437	-.0794	.0132	13654.	559581.	559450.
540.00	41092.	13.2272	-.0832	.0138	13652.	538506.	538373.
550.00	39032.	13.7686	-.0877	.0146	13649.	514823.	514688.
560.00	36973.	14.3763	-.0923	.0154	13647.	488055.	487918.
570.00	34919.	15.0608	-.0978	.0162	13644.	457516.	457377.
580.00	32867.	15.8391	-.1037	.0172	13641.	422468.	422325.
589.40	30939.	16.6736	-.1102	.0182	13638.	384509.	384363.
590.00	30885.	16.6736	-.1102	.0182	13638.	384509.	384363.
599.40	30865.	16.6736	-.1102	.0182	13638.	384509.	384363.

TABLE 16C
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE

S-1B STAGE AERODYNAMIC CHARACTERISTICS

FLIGHT TIME (SEC)	MACH NO.	CENTER OF PRESSURE (M)	AXIAL FORCE COEFFICIENT	NORMAL FORCE COEFFICIENT (1/RAD)
-17.20	0.00	0.0000	0.0000	0.0000
0.00	0.00	20.2360	0.6592	6.0000
10.00	0.09	20.2360	0.6592	6.0000
20.00	0.20	20.2360	0.5230	6.0000
30.00	0.33	20.2360	0.4283	6.0000
40.00	0.51	20.2210	0.3538	6.0054
50.00	0.73	19.6079	0.3412	6.1843
59.70	1.00	18.2780	0.6941	6.7500
60.00	1.01	18.6320	0.7045	6.6596
70.00	1.36	21.3226	0.5997	6.2430
74.39	1.56	22.5654	0.5132	6.0805
80.00	1.86	27.2670	0.4466	5.2085
90.00	2.40	28.6645	0.3869	4.8218
100.00	2.94	28.5780	0.3393	4.7111
110.00	3.55	28.2370	0.3035	4.6157
120.00	4.22	27.9738	0.1600	4.6000
130.00	5.01	27.6297	-0.0809	4.6000
132.00	5.20	27.5460	-0.1395	4.6000
135.62	5.64	28.8338	-0.2956	4.7401
138.62	6.04	34.8184	-0.5525	5.6790
140.00	6.17	35.5181	-0.6177	5.8840
141.62	6.32	35.5665	-0.7457	5.9793
142.72	6.36	35.5770	-0.7804	5.9930
142.92	6.37	35.5770	-0.7830	5.9903
143.00	6.37	35.5770	-0.7841	5.9893

TABLE 17C
TYPICAL PLANAR CASE
TYPICAL LAUNCH WINDOW OPENING
S-IB STAGE PROPULSION CHARACTERISTICS

FLIGHT TIME (SEC)	ALTITUDE (KM)	LONG. (M/S2)	H-1 ENGINE THRUST MAGNITUDES							
			ENGINE 1 (N)	ENGINE 2 (N)	ENGINE 3 (N)	ENGINE 4 (N)	ENGINE 5 (N)	ENGINE 6 (N)	ENGINE 7 (N)	ENGINE 8 (N)
-17.20	0.00	0.000	0.	0.	0.	0.	0.	0.	0.	0.
0.00	0.09	12.145	887185.	895342.	890033.	893819.	896497.	887508.	889802.	892615.
10.00	0.23	13.120	913589.	921774.	916481.	920232.	923000.	913913.	916325.	919023.
20.00	0.71	13.976	927509.	935735.	930421.	934177.	936979.	927864.	930317.	932959.
30.00	1.60	14.678	940115.	948382.	943034.	946818.	949576.	940480.	942918.	945568.
40.00	2.99	15.906	954453.	962669.	957376.	961101.	963924.	954769.	957269.	959851.
50.00	4.95	17.057	971478.	979728.	974403.	978159.	980869.	971799.	974215.	976879.
59.70	7.48	17.492	986352.	994584.	989275.	993016.	995783.	986718.	989128.	991798.
60.00	7.56	17.502	986729.	994978.	989652.	993411.	996178.	987113.	989522.	992193.
60.00	10.83	19.192	1002999.	1011128.	1005922.	1009558.	1012332.	1003327.	1005678.	1008405.
74.39	12.48	20.206	1009231.	1017460.	1012154.	1015891.	1018691.	1009574.	1012037.	1014653.
60.00	14.80	21.520	1015620.	1023873.	1018542.	1022304.	1025020.	1015951.	1018367.	1021030.
90.00	19.56	24.082	1022719.	1030595.	1025638.	1029029.	1031997.	1022864.	1025342.	1027947.
100.00	25.14	29.911	1024568.	1032693.	1027482.	1031149.	1033970.	1024840.	1027313.	1029926.
110.00	31.58	30.622	1022952.	1031069.	1025855.	1029512.	1032471.	1023221.	1025809.	1028316.
120.00	38.88	33.667	1018661.	1026765.	1021548.	1025219.	1028038.	1019049.	1021371.	1024155.
130.00	47.08	38.008	1012022.	1019983.	1014886.	1018451.	1021499.	1012398.	1014821.	1017521.
132.00	48.82	38.979	1010135.	1018339.	1012993.	1016810.	1019604.	1010509.	1012925.	1015634.
135.62	52.07	40.859	1006330.	1014446.	1009174.	1012924.	1015781.	1006698.	1009098.	1011831.
138.62	54.85	42.658	1001623.	1009788.	1004430.	1008258.	1011022.	1001979.	1004352.	1007107.
140.00	56.16	42.048	984221.	992462.	987003.	990973.	41680.	41303.	41399.	41519.
141.62	57.70	49.386	800213.	982357.	802627.	981203.	0.	0.	0.	0.
142.72	58.74	1.448	78627.	44617.	78852.	44551.	0.	0.	0.	0.
142.92	58.92	1.493	65871.	42290.	66059.	42227.	0.	0.	0.	0.
143.00	59.00	1.423	60253.	40890.	60426.	40830.	0.	0.	0.	0.

TABLE 18 C

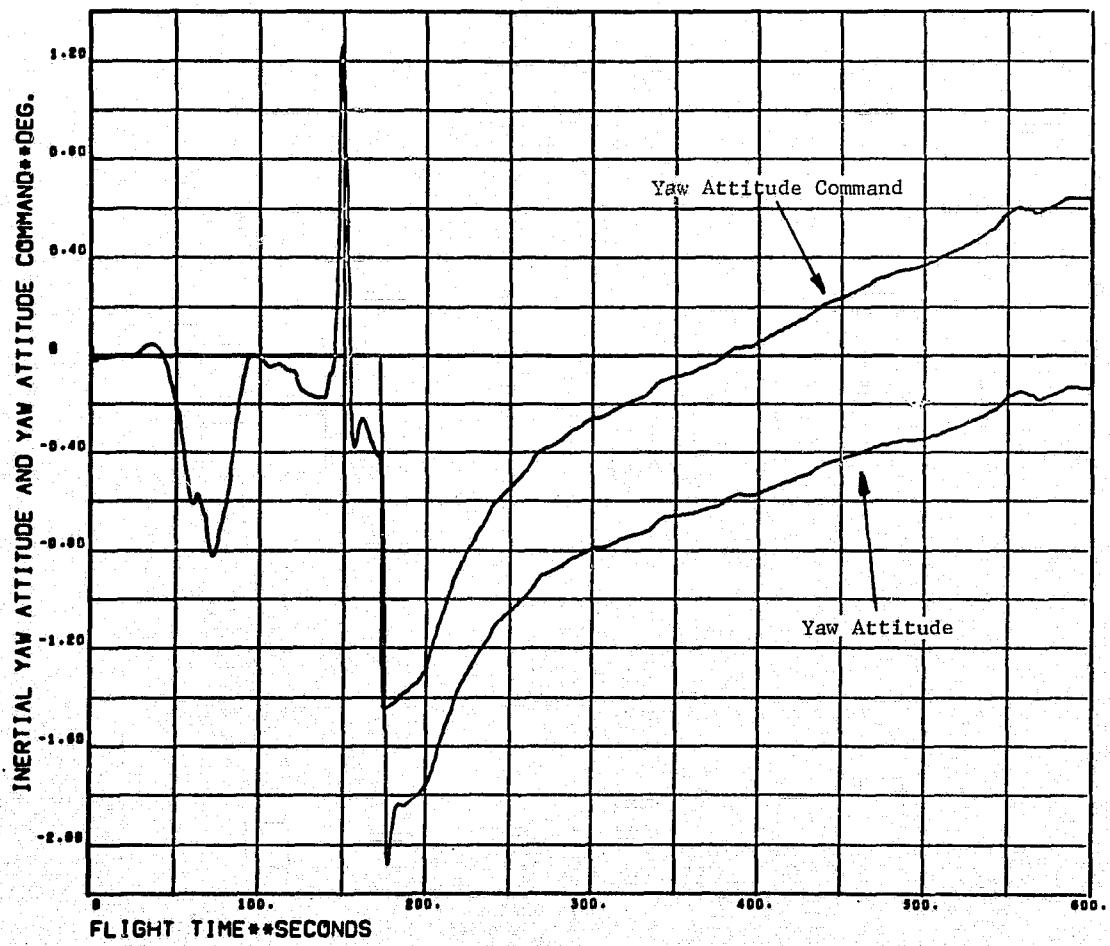
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE

S-4B STAGE PROPULSION CHARACTERISTICS

FLIGHT TIME (SEC)	ALTITUDE (KM)	LONGITUDINAL ACCELERATION (M/S ²)	THRUST MAGNITUDE J-2 ENGINE (N)
143.00	59.00	.265	0.
144.32	60.24	.268	0.
147.72	63.34	5.792	798732.
150.72	66.01	6.279	866856.
154.92	69.66	7.442	1019172.
160.00	73.95	7.518	1019337.
166.31	79.09	7.784	1019765.
166.62	79.34	7.804	1019713.
170.00	82.00	7.923	1021335.
171.75	83.36	7.987	1026181.
180.00	89.54	8.093	1023226.
190.00	96.67	8.255	1023360.
200.00	103.40	8.422	1023438.
210.00	109.76	8.577	1021221.
220.00	115.75	8.751	1020447.
230.00	121.36	8.920	1018423.
240.00	126.62	9.112	1017984.
250.00	131.51	9.302	1016538.
260.00	136.06	9.514	1016512.
270.00	140.27	9.751	1017894.
280.00	144.15	9.991	1018571.
290.00	147.69	10.229	1017727.
300.00	150.91	10.476	1016660.
310.00	153.82	10.753	1017254.
320.00	156.43	11.030	1016515.
330.00	158.74	11.339	1017338.
340.00	160.76	11.676	1018955.
350.00	162.51	11.996	1017470.
360.00	163.98	12.342	1016661.
370.00	165.20	12.706	1015560.
380.00	166.18	13.152	1018962.
390.00	166.92	13.514	1013965.
400.00	167.44	13.967	1013822.
410.00	167.76	14.449	1013540.
420.00	167.90	14.967	1013301.

TABLE 18C (Continued)			
APOLLO SOYUZ TEST PROJECT			
TYPICAL PLANAR CASE			
S-4B STAGE PROPULSION CHARACTERISTICS			
FLIGHT TIME (SEC)	ALTITUDE (KM)	LONGITUDINAL ACCELERATION (M/S ²)	THRUST MAGNITUDE J-2 ENGINE (LN)
430.00	167.86	15.577	1016529.
440.00	167.67	16.199	1017444.
450.00	167.34	16.791	1013580.
460.00	166.91	17.495	1013339.
470.00	166.38	18.240	1012726.
470.25	166.37	16.456	912754.
480.00	165.77	16.081	858799.
490.00	165.05	16.722	858864.
500.00	164.24	17.416	858732.
510.00	163.39	18.169	858559.
520.00	162.52	18.991	858380.
530.00	161.66	19.890	858179.
540.00	160.84	20.879	857962.
550.00	160.10	22.081	861875.
560.00	159.47	23.224	858674.
570.00	159.00	24.577	858237.
580.00	158.71	26.093	857623.
589.40	158.67	27.692	856777.
590.00	158.70	1.713	52920.
599.40	158.84	-.000	0.

FIGURE 1C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
INERTIAL YAW ATTITUDE AND YAW ATTITUDE COMMAND HISTORIES



TIME .VS. CH12 , THZ

FIGURE 2C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
ALTITUDE VS. GROUND RANGE

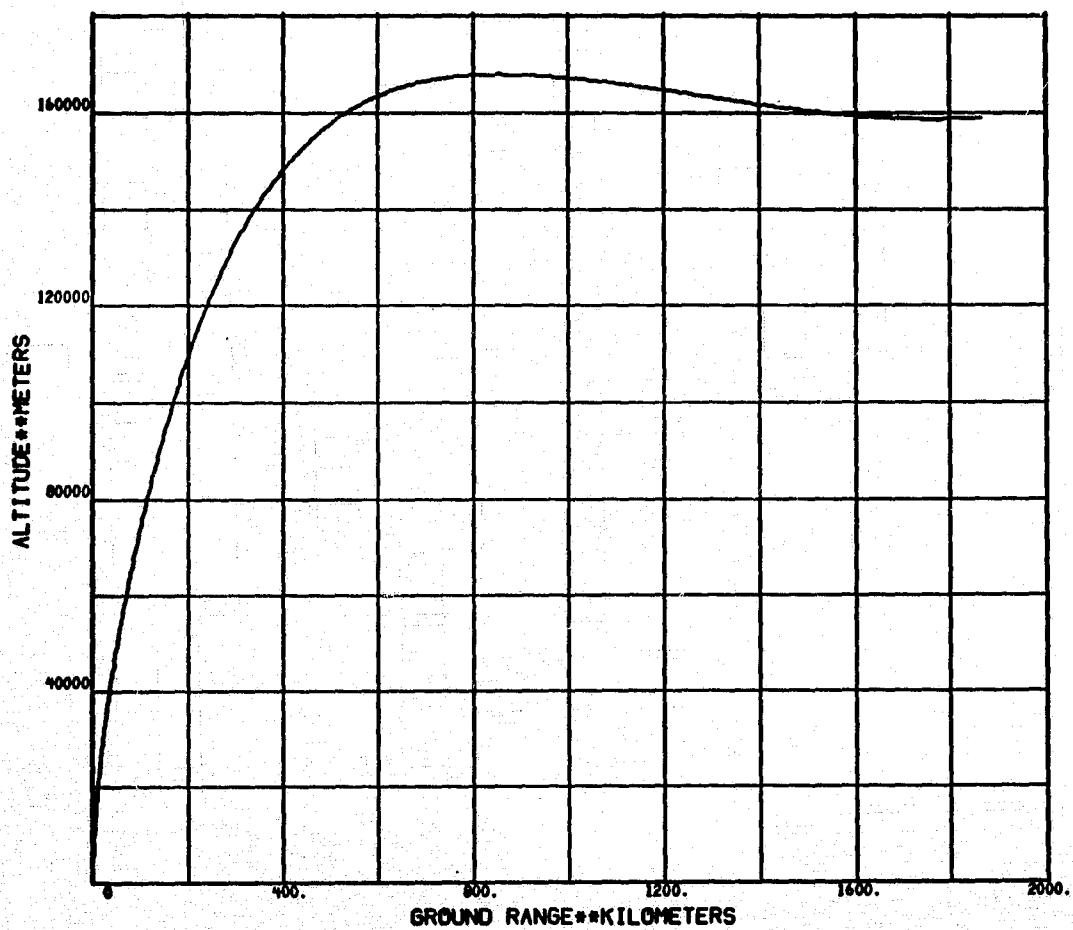
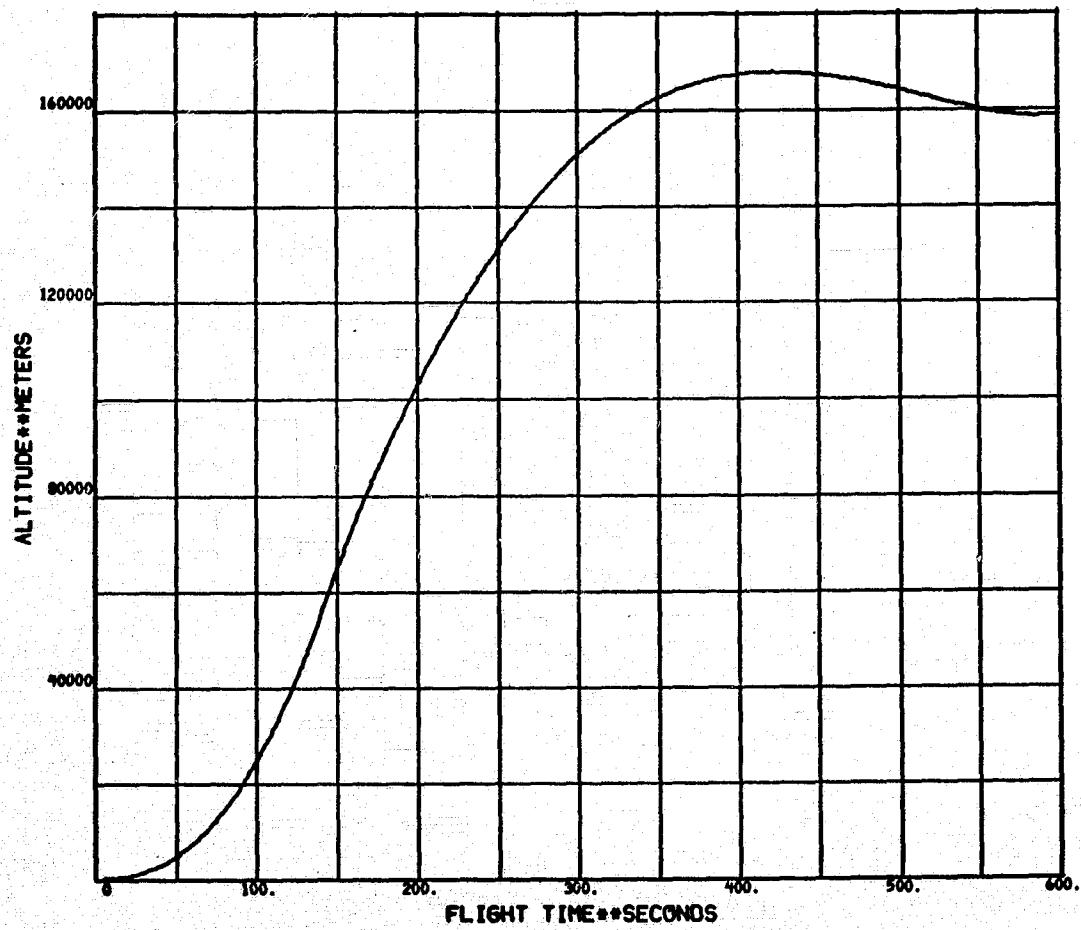


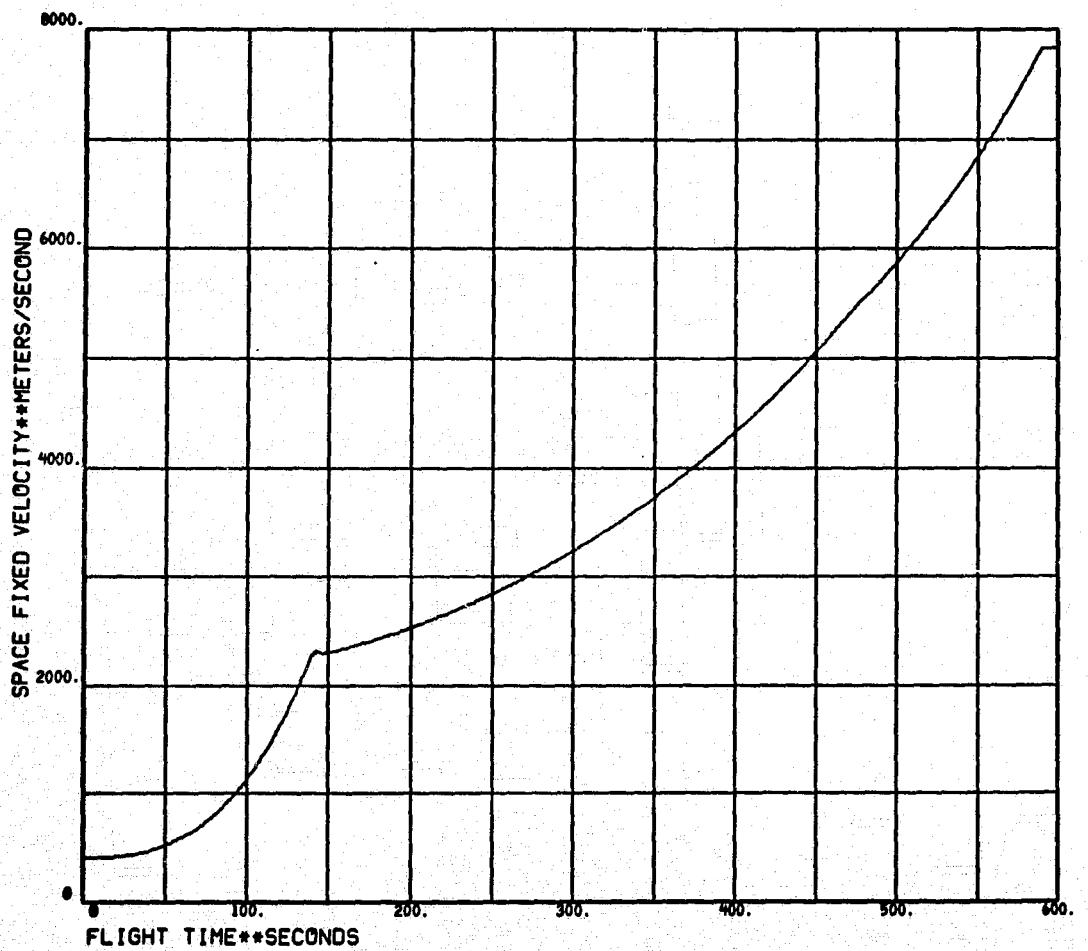
FIG. 2C VS. ALT

FIGURE 3C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
ALTITUDE HISTORY



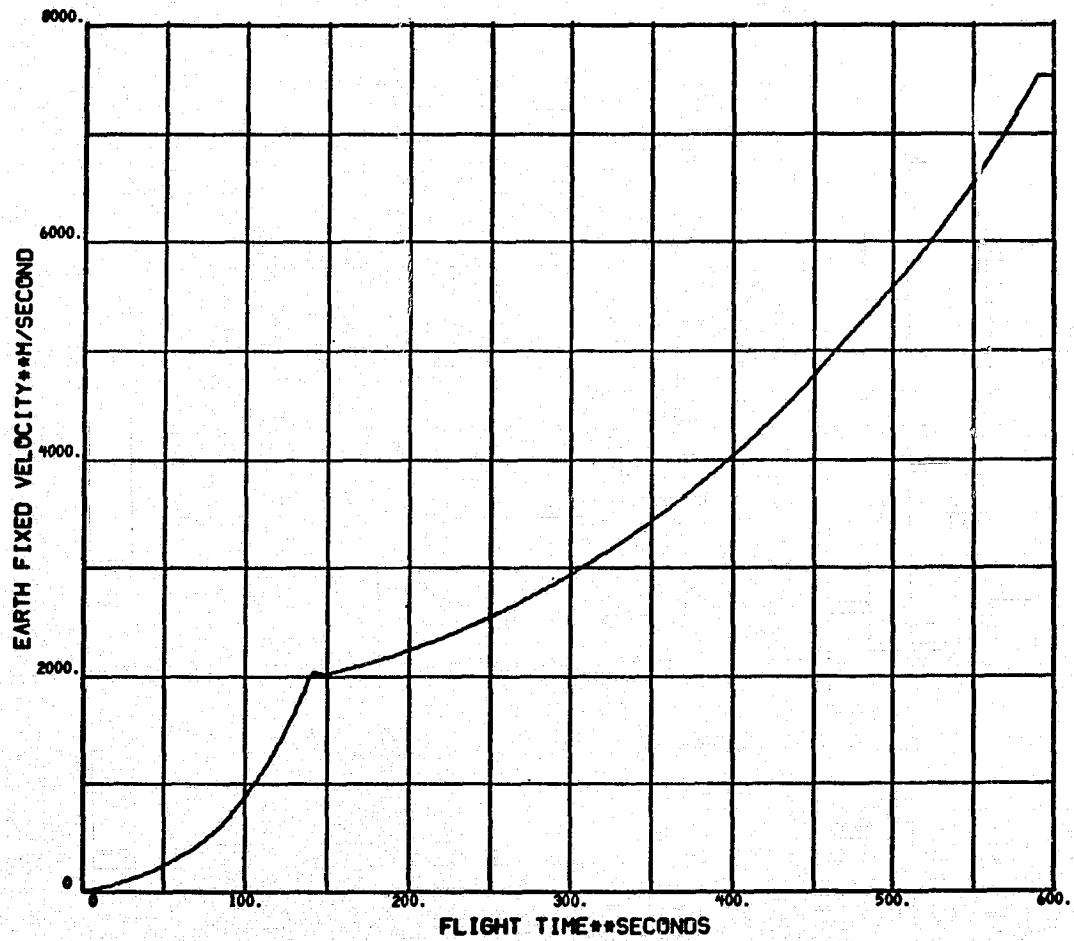
TIME .VS. ALT

FIGURE 4C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
SPACE FIXED VELOCITY HISTORY



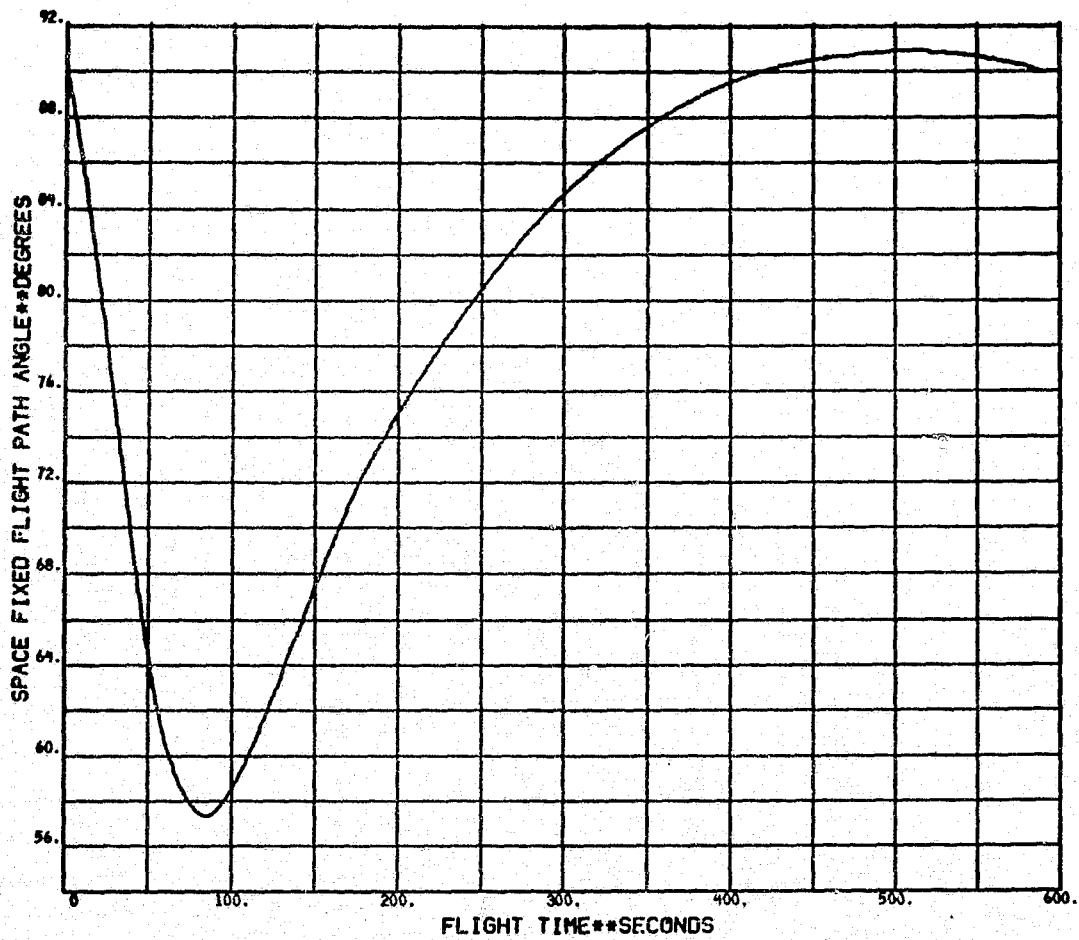
TIME .VS. VS

FIGURE 5C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
EARTH FIXED VELOCITY HISTORY



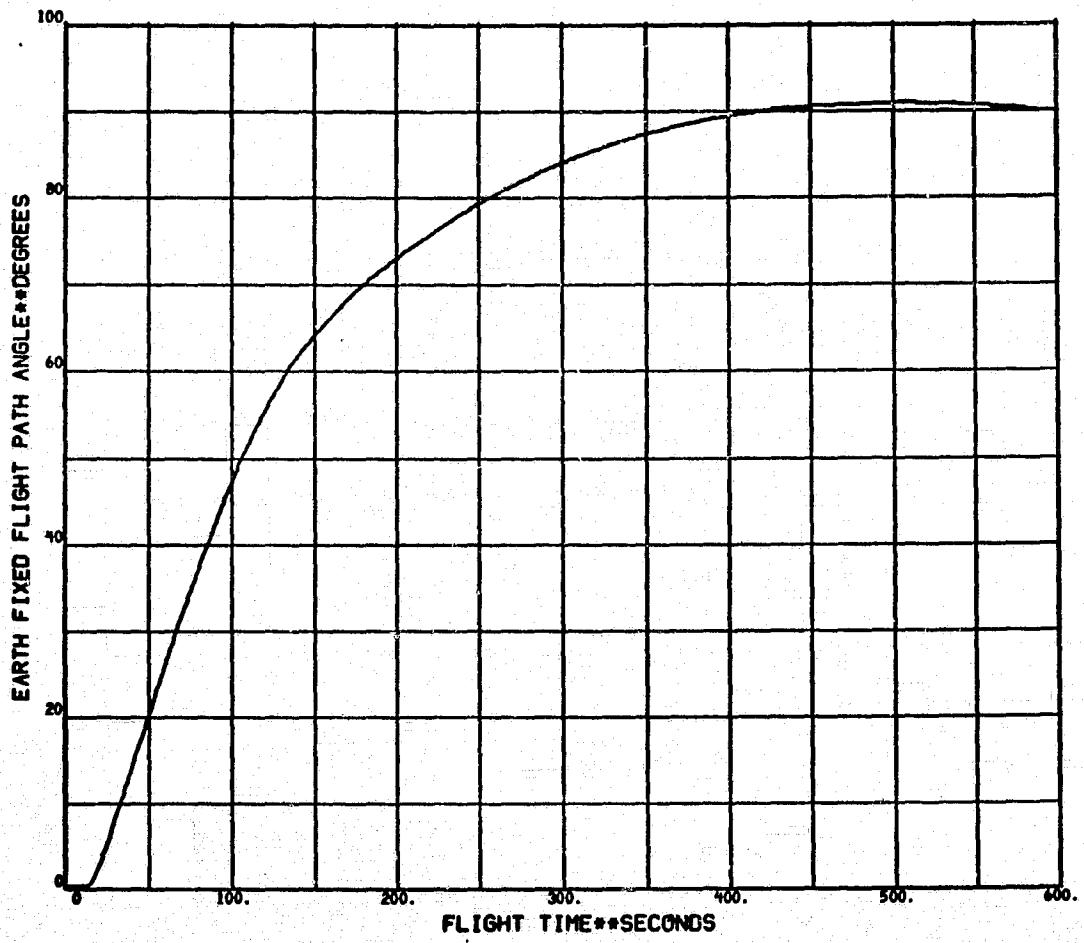
TIME .VS. VEL

FIGURE 6C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
SPACE FIXED PATH ANGLE HISTORY



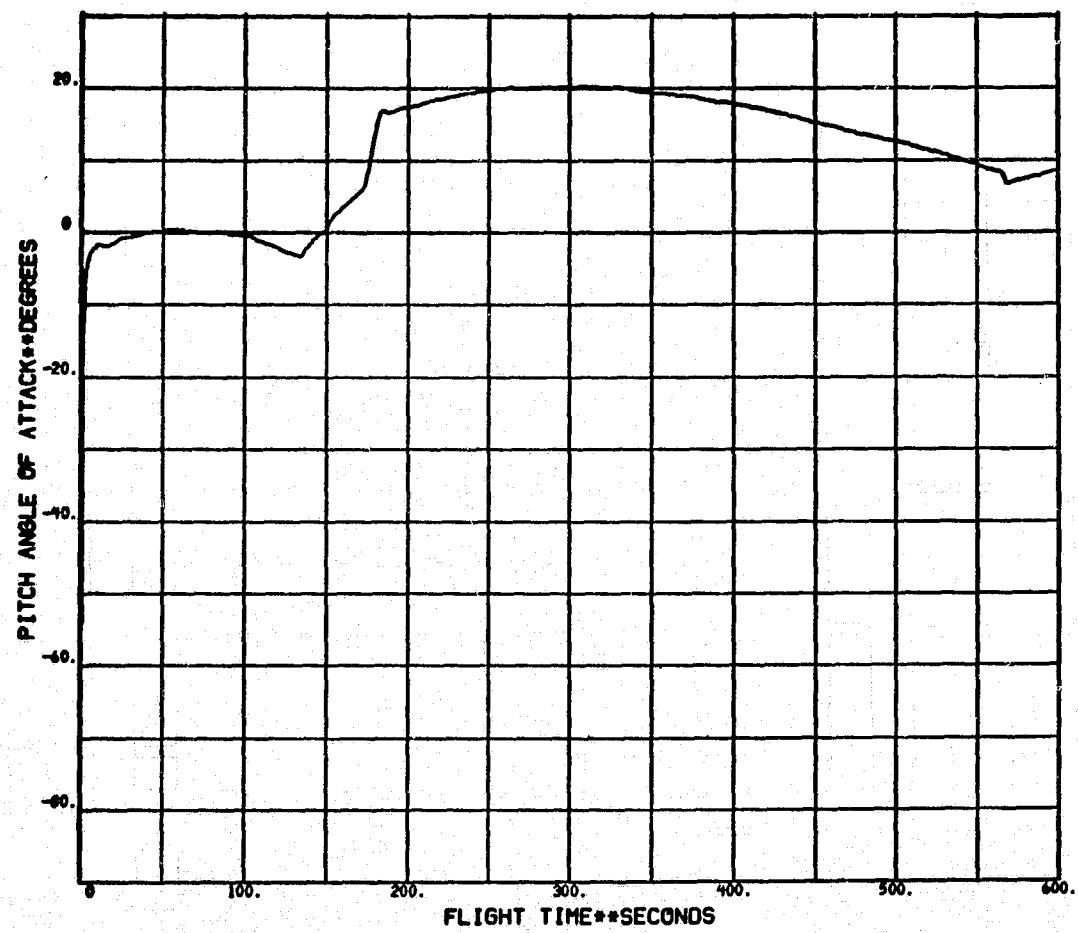
TIME .VS. THETAS

FIGURE 7C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
EARTH FIXED PATH ANGLE HISTORY



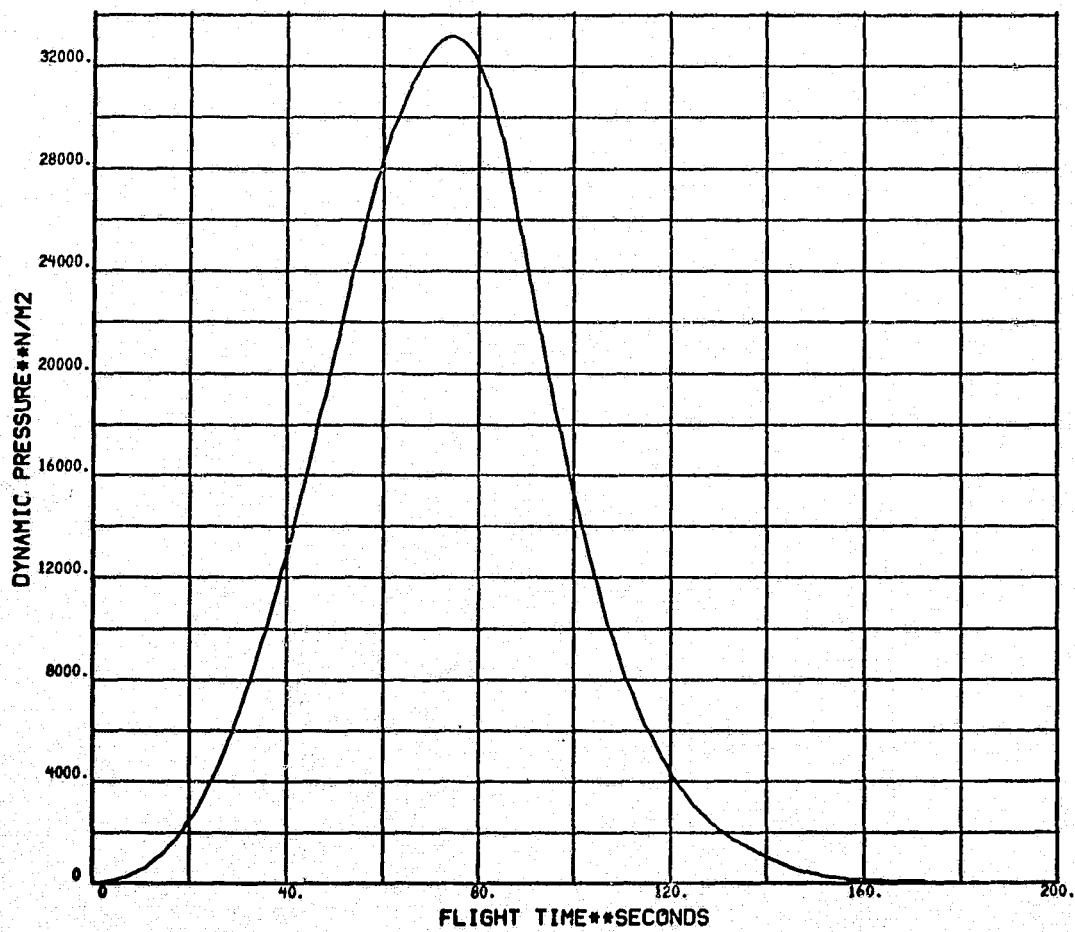
TIME .VS. THETA_E

FIGURE 8C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
PITCH ANGLE OF ATTACK HISTORY



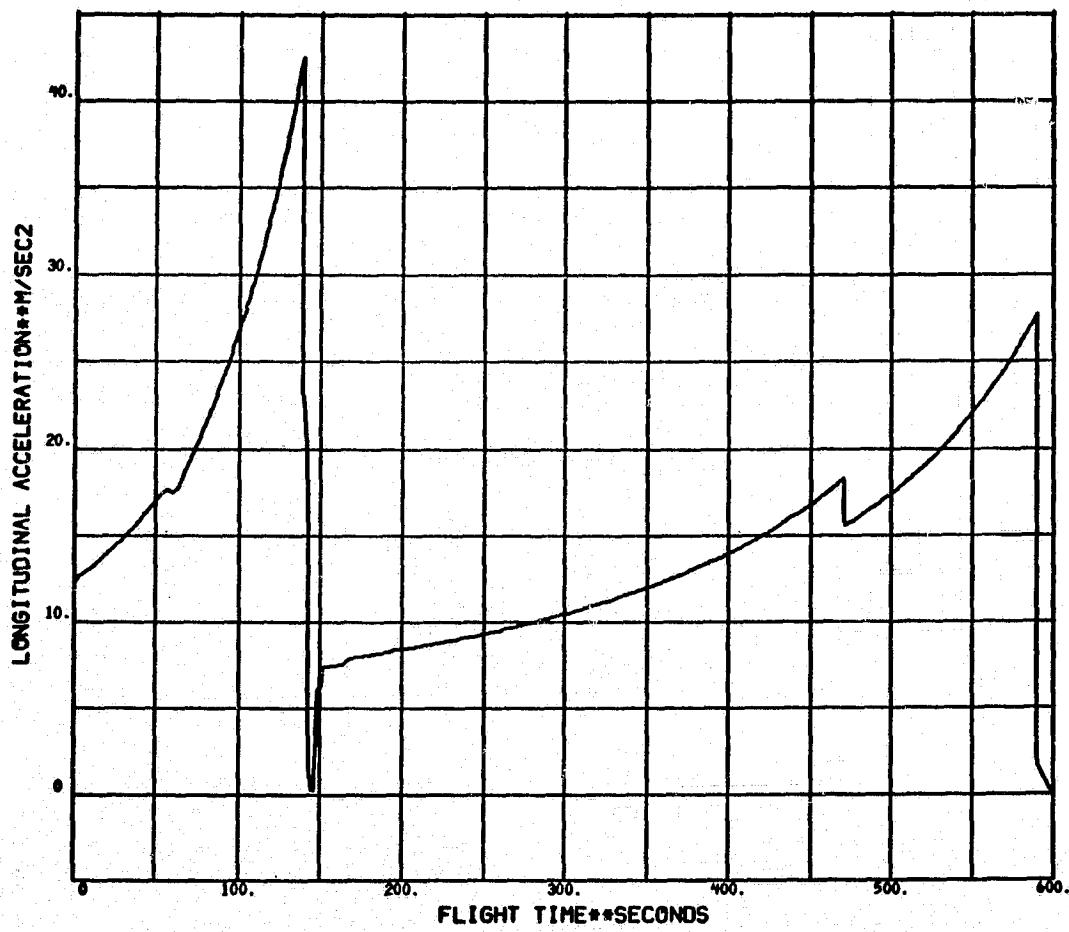
TIME .VS. ALPHAP

FIGURE 9C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
DYNAMIC PRESSURE HISTORY



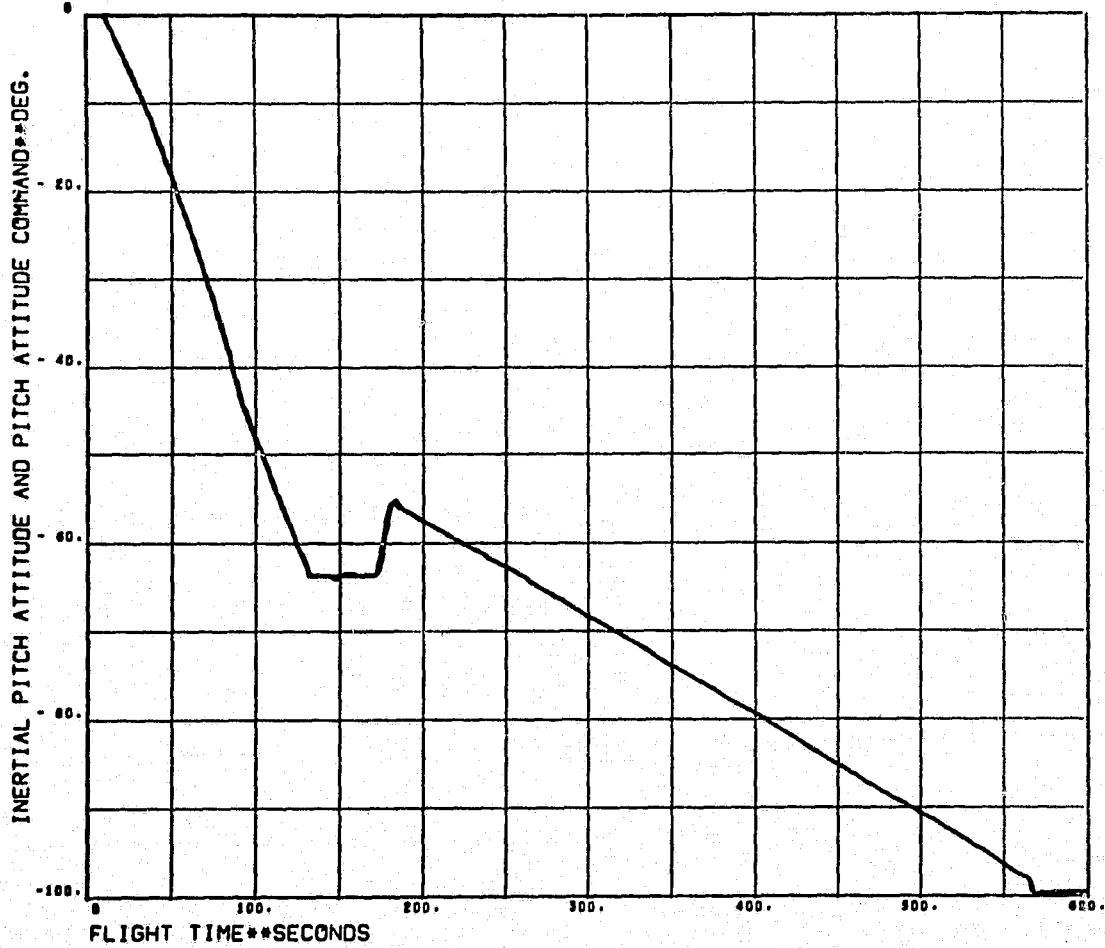
TIME .VS. 0

FIGURE 10C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
LONGITUDINAL ACCELERATION HISTORY



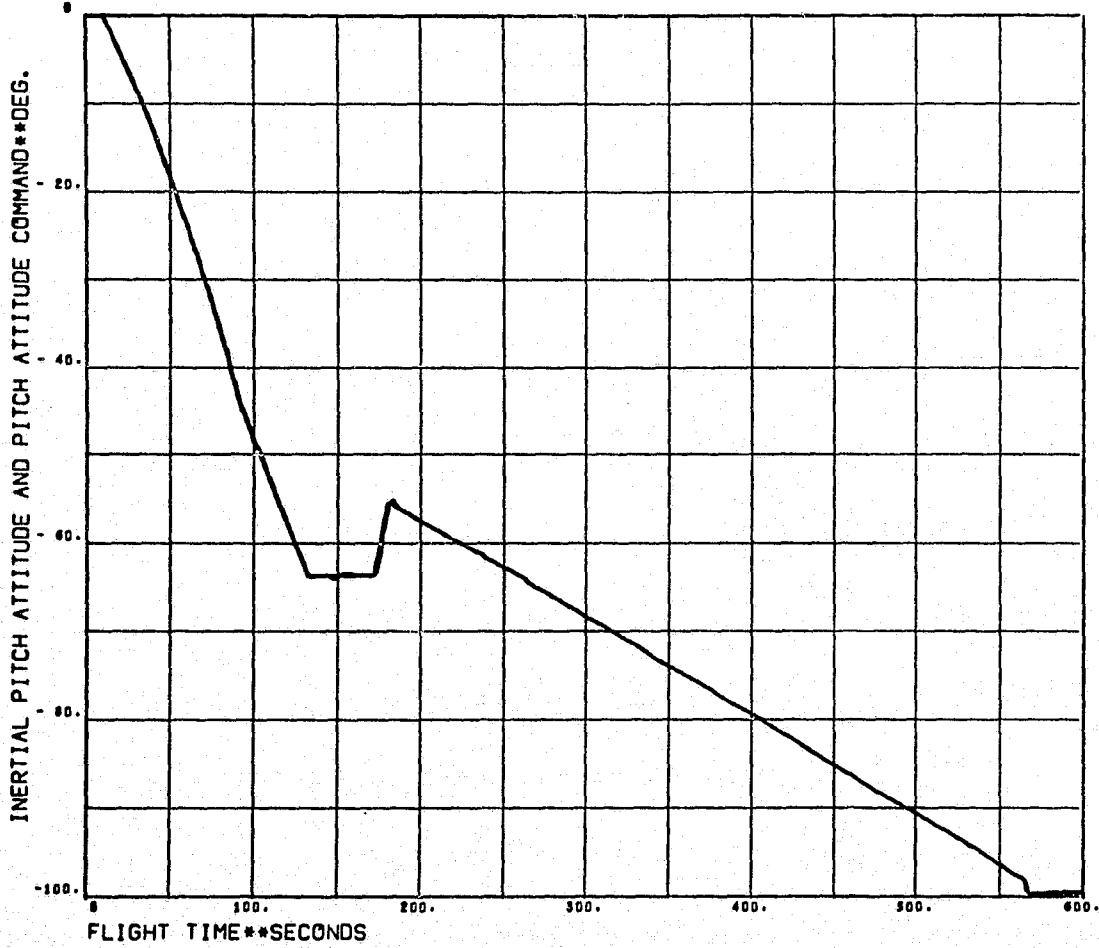
TIME .VS. AXB

FIGURE 11C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
INERTIAL PITCH ATTITUDE AND PITCH ATTITUDE COMMAND HISTORIES



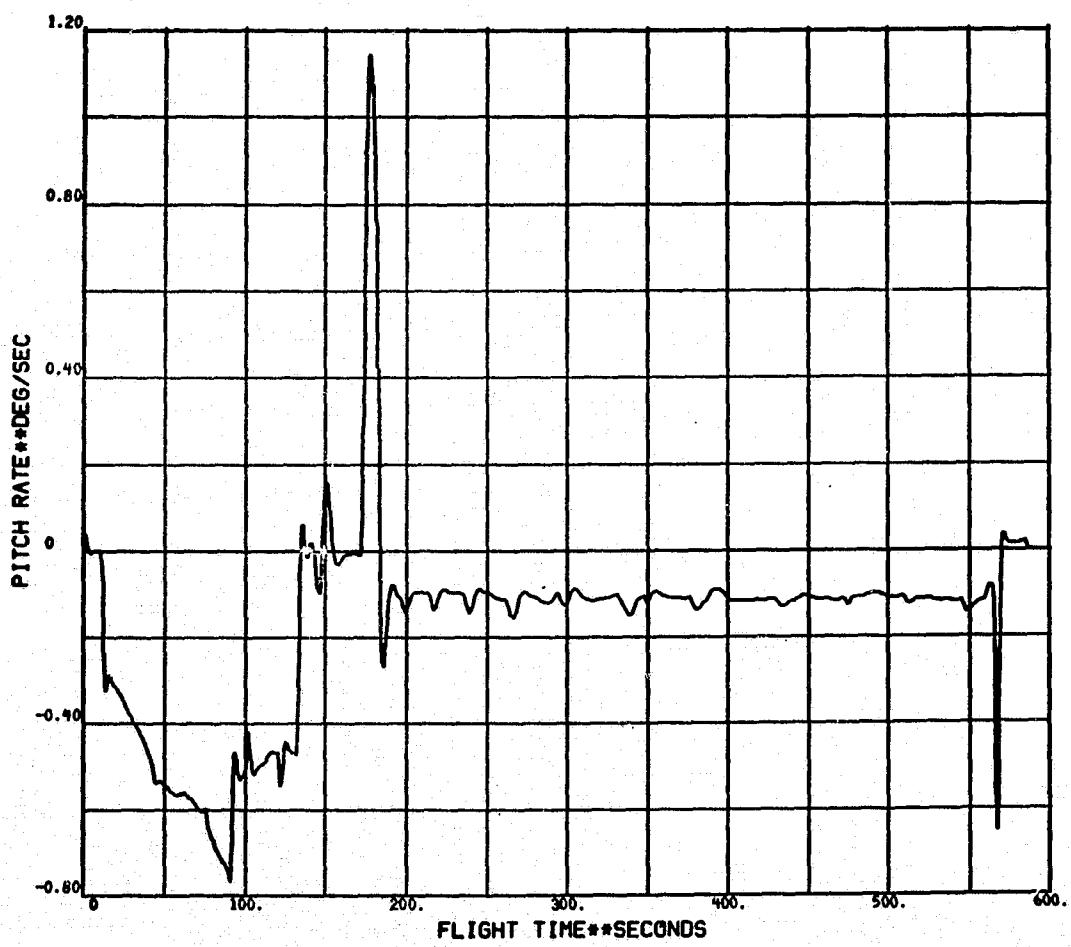
TIME .VS. CHIT , THY

FIGURE 11C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
INERTIAL PITCH ATTITUDE AND PITCH ATTITUDE COMMAND HISTORIES



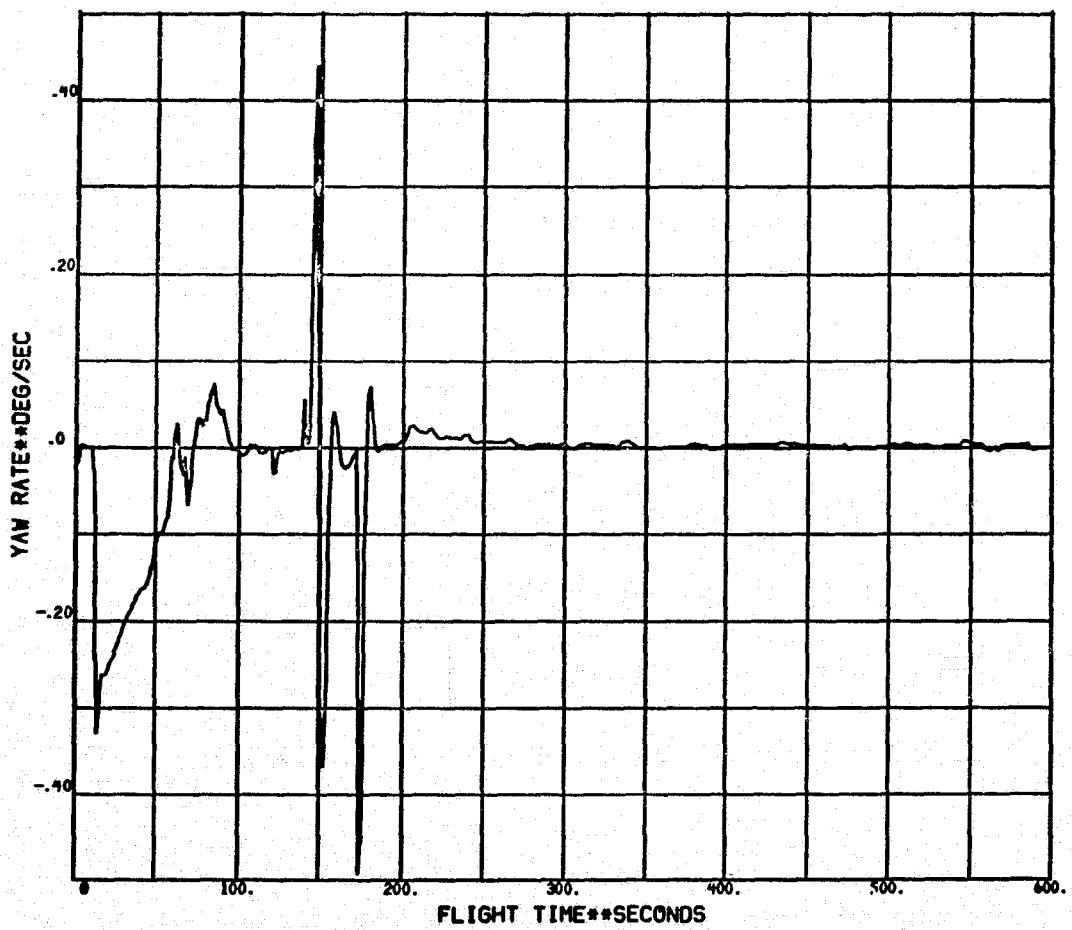
TIME .VS. CHIT . THY

FIGURE 12C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
BODY PITCH RATE HISTORY



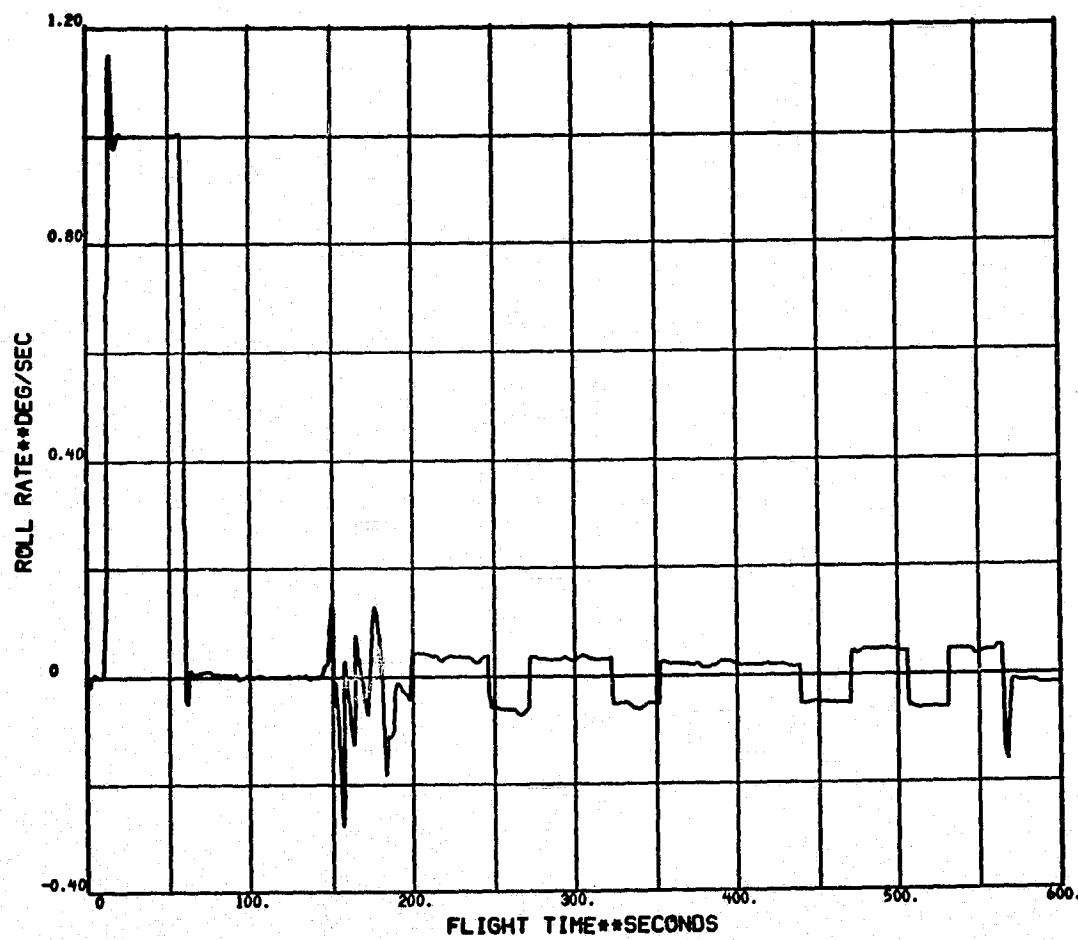
TIME .VS. VPHTY

FIGURE 13C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
BODY YAW RATE HISTORY



TIME .VS. VPHIZ

FIGURE 14C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
BODY ROLL RATE HISTORY



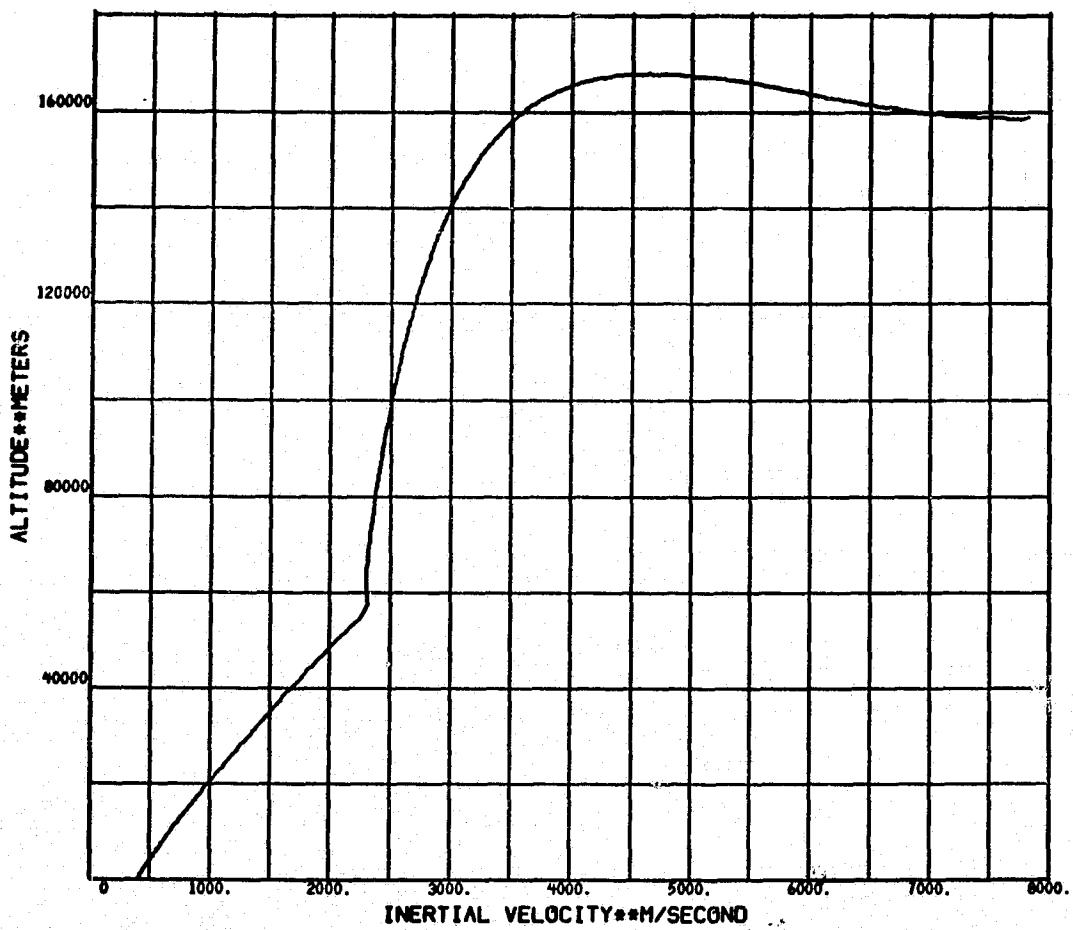
TIME .VS. VPHIX

FIGURE 15C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
INERTIAL PATH ANGLE VS. INERTIAL VELOCITY



VS .VS. THETAS

FIGURE 16C
APOLLO/SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
ALTITUDE VS. INERTIAL VELOCITY



VS .VS. ALT

APPENDIX D

**TRAJECTORY LISTING FOR A
TYPICAL PLANAR CASE
ENGLISH UNITS**

TABLE 1D

APOLLO SOYUZ TEST PROJECT
S-IB STAGE END CONDITIONS OF FLIGHT
TYPICAL PLANAR CASE

Flight Time: OECO + 1.379 seconds	143.0	(sec)
Radius:	21102834.	(ft)
Altitude:	193563.	(ft)
Space Fixed Velocity:	7577.21	(ft/s)
Space Fixed Path Angle:	66.099	(deg)
Space Fixed Flight Azimuth:	51.349	(deg)
Earth Fixed Flight Azimuth:	43.199	(deg)
Geocentric Declination:	28.909	(deg)
Geodetic Latitude:	29.072	(deg)
Longitude: (Pos. East)	-80.145	(deg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	21099339.	(ft)
Ys	=	198717.	(ft)
Zs	=	328671.	(ft)
Xs	=	2953.75	(ft/s)
Ys	=	980.19	(ft/s)
Zs	=	6908.59	(ft/s)

VEHICLE ATTITUDE AND ATTITUDE RATE

Pitch Attitude Angle	=	-63.757	(deg)
Yaw Attitude Angle	=	-0.062	(deg)
Roll Attitude Angle	=	0.005	(deg)
Pitch Rate	=	-0.009	(deg/s)
Yaw Rate	=	0.016	(deg/s)
Roll Rate	=	0.004	(deg/s)

TABLE 2D

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL PLANAR CASE

Flight Time: Guidance Cutoff Signal	589.40	(sec)
Radius:	21417935.	(ft)
Altitude:	520631.	(ft)
Space Fixed Velocity:	25645.13	(ft/s)
Space Fixed Flight Path Angle:	90.009	(deg)
Space Fixed Flight Azimuth:	53.621	(deg)
Earth Fixed Flight Azimuth:	51.961	(deg)
Geocentric Declination:	39.472	(deg)
Geodetic Latitude:	39.661	(deg)
Longitude: (Pos. East)	-66.350	(deg)
Inclination:	51.574	(deg)
Descending Node Argument:	156.014	(deg)
Inertial Range Angle:	17.706	(deg)
Weight:	68209.	(lbs)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	20415658.	(ft)
Ys	=	528267.	(ft)
Zs	=	6453666.	(ft)
Xs	=	-7743.14	(ft/s)
Ys	=	449.55	(ft/s)
Zs	=	24444.11	(ft/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-99.564	(deg)
Yaw Attitude Angle	=	-0.129	(deg)
Roll Attitude Angle	=	-0.035	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	491371.39	(ft)
*Apogee Altitude	=	521883.20	(ft)
Eccentricity	=	.00071	
Semi-Major Axis	=	21432349.11	(ft)
True Anomaly	=	346.45	(deg)
Period	=	87.58	(min)

*Referenced to Equatorial Radius (20925721.78 ft)

TABLE 2D (CONTINUED)

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL PLANAR CASE

Flight Time: Orbit Insertion	599.40	(sec)
Radius:	21417930.	(ft)
Altitude:	521114.	(ft)
Space Fixed Velocity:	25669.13	(ft/s)
Space Fixed Flight Path Angle:	90.000	(deg)
Space Fixed Flight Azimuth:	54.081	(deg)
Earth Fixed Flight Azimuth:	52.450	(deg)
Geocentric Declination:	39.877	(deg)
Geodetic Latitude:	40.066	(deg)
Longitude: (Pos. East)	-65.671	(deg)
Inclination:	51.575	(deg)
Descending Node Argument:	156.015	(deg)
Inertial Range Angle:	18.392	(deg)
Weight:	68046.	(lbs)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	20336727.	(ft)
Ys	=	532725.	(ft)
Zs	=	6697872.	(ft)
Xs	=	-8039.00	(ft/s)
Ys	=	442.11	(ft/s)
Zs	=	24373.82	(ft/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-99.564	(deg)
Yaw Attitude Angle	=	- 0.135	(deg)
Roll Attitude Angle	=	- 0.218	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	492191.62	(ft)
*Apogee Altitude	=	601509.21	(ft)
Eccentricity	=	.00255	
Semi-Major Axis	=	21472572.21	(ft)
True Anomaly	=	0.094	(deg)
Period	=	87.82	(min)

*Referenced to Equatorial Radius (20925721.78 ft)

TABLE 3D
APOLLO SOYUZ TEST PROJECT
SEQUENCE OF EVENTS
TYPICAL PLANAR CASE

FLIGHT TIME (SEC)	PROGRAM TIME (SEC)	
-17.20	---	Guidance Reference Release (GRR)
0.00	---	First Motion
0.20	(0.00) ₁	Lift-off Signal; Initiate Time Base One
59.70	---	Mach One
74.39	---	Maximum Dynamic Pressure
132.00	(131.80) ₁	Tilt Arrest
135.62	(0.00) ₂	Level Sensor Activation; Initiate Time Base Two
138.62	(3.00) ₂	Inboard Engine Cutoff (IECO)
141.62	(0.00) ₃	Outboard Engine Cutoff (OECO); Initiate Time Base Three
142.72	(1.10) ₃	Ignite Ullage Rockets
142.92	(1.30) ₃	Separation Signal
143.00	---	S-IB/S-IVB Physical Separation
144.32	(2.70) ₃	S-IVB J-2 Engine Start Command
147.72	---	90 Percent J-2 Thrust Level
150.72	---	Termination of Ullage Burn
154.92	(13.30) ₃	Jettison Ullage Rockets
166.32	---	Dynamic Pressure = 1 PSF
166.62	---	LES Jettison
171.75	(30.00) ₃	IGM Initiation
469.72	(328.10) ₃	EMR Shift Command
589.40	---	Guidance Cutoff Signal (GCS)
589.60	(0.00) ₄	Inertial Attitude Freeze; Initiate Time Base Four
599.40	---	Orbit Insertion (OI)

TABLE 4D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC ²)	DYNAMIC PRESSURE (LB/FT ²)	A.M.I. (LB-FT/FT ² -RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1) -17.20	1311032	0	0	+000	0	0	0.00	N/A
2) 0.00	1296854	1603375	59	39.847	0	0	0.00	N/A
10.00	1234179	1651115	2568	43.044	11	1601	0.09	+1.764
20.00	1171128	1676514	9893	45.852	52	33020	0.20	-1.350
30.00	1107765	1699799	21287	48.812	137	211731	0.33	+.598
40.00	1044310	1726631	34792	52.187	269	823147	0.51	.001
50.00	980797	1758273	54063	55.961	435	2364083	0.73	.217
3) 59.70	919192	1786104	148029	57.387	589	5462806	1.00	.267
60.00	917296	1786837	151168	57.421	593	5582358	1.01	.280
70.00	853472	1816954	147816	62.966	681	10560824	1.36	.064
4) 74.39	825457	1828643	128762	66.292	693	13356273	1.56	-0.057
80.00	789610	1840524	108104	70.604	670	17384486	1.86	.067
90.00	725982	1853495	70701	79.010	507	25017955	2.40	-.233
100.00	662622	1857285	38973	88.290	318	31705363	2.94	-.510
110.00	599406	1854530	19667	98.497	178	36713576	3.55	-1.313
120.00	536416	1846826	5471	110.456	91	40061088	4.22	-2.116
130.00	473755	1834856	-1092	124.699	45	42132729	5.01	-3.079
5) 132.00	461292	1831562	-1747	127.884	39	42438253	5.20	-3.274
6) 135.62	438723	1824658	-3152	134.051	31	42921718	5.84	-2.555
7) 138.62	420125	1816163	-4867	139.461	25	43270962	6.04	-1.655
140.00	414938	928067	-4812	72.337	22	43404976	6.17	-1.314
8) 141.62	408807	803133	-4993	63.602	19	43583935	6.32	.826
9) 142.72	407413	55545	-4619	4.752	16	43685067	6.36	.544
10) 142.92	407159	57475	-4527	4.900	16	43698890	6.37	.498
11) 143.00	407130	54594	-4492	4.670	16	43703989	6.37	.481

- 1) Guidance Reference Release
- 2) First Motion
- 3) Mach One
- 4) Maximum Dynamic Pressure
- 5) Tilt Arrest
- 6) LSA, Initiate Time Base Two
- 7) IECO
- 8) OECO, Initiate Time Base Three
- 9) Ignite Ullage Rockets
- 10) Separation Signal
- 11) S-IB/S-IVB Physical Separation

TABLE 5D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	SPACE FIXED			SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS						
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)	
-17.00	20910035.	1340.44	90.000	20909952.	40127.	-43182.	0.00	981.93	912.47	
0.00	20910034.	1340.44	90.000	20909939.	57612.	-27483.	-1.48	981.38	913.06	
10.00	20910497.	1343.56	85.853	20910383.	66822.	-18350.	94.84	980.72	913.42	
20.00	20912059.	1365.53	80.732	20911917.	76627.	-9182.	216.74	980.27	925.61	
30.00	20914984.	1428.01	75.010	20914866.	86428.	276.	365.30	980.16	972.14	
40.00	20919536.	1542.57	69.294	20919312.	96241.	10395.	540.36	983.02	1058.86	
50.00	20925979.	1719.75	64.249	20925699.	166099.	21621.	740.93	988.74	1196.22	
59.70	20934253.	1952.80	60.631	20933905.	115716.	34109.	949.98	993.39	1387.14	
60.00	20934539.	1960.63	60.951	20934190.	116012.	34524.	956.16	993.52	1393.82	
70.00	20945240.	2260.94	58.522	20944862.	125982.	49702.	1170.67	1000.81	1655.22	
74.39	20950647.	2421.73	57.943	20950163.	130377.	57270.	1274.23	1003.22	1798.51	
80.00	20958258.	2655.62	57.488	20957707.	136017.	67945.	1414.34	1005.71	2010.10	
90.00	20973853.	3154.35	57.549	20973150.	146065.	90279.	1674.98	1002.75	2477.67	
100.00	20992126.	3768.70	58.587	20991215.	156072.	117936.	1939.64	999.28	3072.84	
110.00	21013180.	4501.22	60.051	21011973.	166054.	152151.	2211.94	997.06	3791.33	
120.00	21037086.	5362.86	61.796	21035453.	176011.	194232.	2483.50	994.01	4648.06	
130.00	21063873.	6371.70	63.710	21061620.	185926.	245653.	2747.61	988.51	5663.22	
132.00	21069575.	6593.14	64.106	21067167.	187902.	257204.	2798.94	987.10	5887.30	
135.62	21080202.	7012.73	64.808	21077482.	191475.	279312.	2892.75	984.37	6312.00	
138.62	21089301.	7378.61	65.313	21086288.	194425.	298798.	2978.48	982.02	6678.93	
140.00	21093554.	7479.54	65.551	21090395.	195775.	308066.	2987.87	981.23	6786.26	
141.02	21098549.	7571.76	65.833	21095251.	197369.	319178.	2986.93	980.57	6888.27	
142.72	21101989.	7579.38	66.044	21098526.	198447.	326772.	2961.85	980.20	6907.50	
142.92	21102604.	7577.81	66.083	21099117.	198643.	328153.	2955.97	980.21	6908.31	
143.00	21102834.	7577.21	66.098	21099339.	198717.	328671.	2953.75	980.19	6908.59	

TABLE 6D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
5-18 STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
-17.20	295.	.00	N/A	295.	0.	0.	.00	.00	.00
0.00	295.	.00	N/A	295.	0.	0.	.00	.00	.00
10.00	758.	97.17	0.400	758.	-2.	-0.	97.17	0.49	0.11
20.00	2320.	220.25	3.112	2320.	-9.	30.	219.95	0.93	11.43
30.00	5256.	373.86	8.905	5245.	-21.	342.	369.48	1.20	57.08
40.00	9885.	564.03	14.766	9799.	-23.	1304.	545.69	1.35	142.66
50.00	16590.	797.93	20.545	16246.	16.	3362.	747.69	1.64	278.56
59.70	25489.	1066.60	26.115	24526.	103.	6938.	958.51	10.84	467.75
60.00	25803.	1075.13	26.286	24813.	106.	7079.	964.75	10.96	474.37
70.00	37846.	1390.99	31.925	35523.	248.	13052.	1181.62	17.91	733.70
74.39	44165.	1556.48	34.329	40935.	332.	16576.	1286.44	20.21	875.94
80.00	53334.	1794.55	37.309	48552.	453.	22068.	1428.40	22.62	1086.08
90.00	73156.	2296.09	42.510	64156.	670.	35148.	1693.13	19.85	1550.78
100.00	98282.	2906.12	47.476	82427.	852.	53520.	1963.16	17.20	2142.71
110.00	129819.	3632.35	51.783	103454.	1021.	78417.	2242.33	16.58	2857.56
120.00	168977.	4486.62	55.604	127279.	1185.	111139.	2522.54	16.16	3710.29
130.00	217122.	5487.73	59.052	153888.	1341.	153162.	2797.45	14.68	4721.15
132.00	227963.	5707.61	59.704	159538.	1370.	162828.	2851.23	14.28	4944.40
135.62	248731.	6124.54	60.832	170051.	1420.	181515.	2944.77	13.55	5367.37
138.62	267066.	6488.85	61.645	179034.	1460.	198164.	3039.67	12.97	5732.84
140.00	275797.	6588.50	61.975	183227.	1478.	206131.	3050.60	12.90	5839.69
141.62	286260.	6678.99	62.347	188186.	1499.	215705.	3051.34	13.07	5941.22
142.72	293402.	6684.94	62.589	191532.	1513.	222256.	3027.06	13.23	5960.30
142.92	294700.	6683.03	62.633	192136.	1516.	223449.	3021.30	13.26	5961.08
143.00	295187.	6682.30	62.649	192363.	1517.	223896.	3019.13	13.27	5961.36

TABLE 7 D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
-17.20	0.	0.000	0.00	90.000	N/A	-80.621	28.466	28.627
0.00	295.	0.000	3.91	90.000	N/A	-80.621	28.466	28.627
10.00	758.	0.001	97.28	89.978	39.356	-80.621	28.466	28.627
20.00	2321.	0.006	220.19	89.591	36.407	-80.621	28.466	28.627
30.00	5246.	0.058	372.75	88.186	41.013	-80.620	28.467	28.628
40.00	9799.	0.218	559.73	85.823	43.021	-80.618	28.469	28.630
50.00	16247.	0.558	786.74	82.524	43.968	-80.614	28.473	28.634
59.70	24528.	1.149	1044.58	78.555	44.006	-80.605	28.480	28.641
60.00	24815.	1.172	1052.67	78.428	44.003	-80.606	28.480	28.642
70.00	35528.	2.157	1352.04	74.110	44.131	-80.593	28.492	28.653
74.39	40942.	2.737	1510.02	72.107	44.074	-80.585	28.499	28.660
80.00	48564.	3.640	1749.07	69.539	43.969	-80.573	28.509	28.671
90.00	64186.	5.789	2280.23	65.009	43.548	-80.545	28.535	28.697
100.00	82496.	8.802	2885.51	61.018	43.313	-80.506	28.572	28.734
110.00	103601.	12.878	3578.08	57.779	43.225	-80.453	28.621	28.783
120.00	127574.	18.224	4414.92	55.170	43.187	-80.383	28.686	28.848
130.00	154447.	25.075	5417.61	53.006	43.168	-80.294	28.769	28.932
132.00	160169.	26.649	5642.53	52.698	43.167	-80.274	28.788	28.951
135.62	170835.	29.690	6063.34	52.073	43.168	-80.234	28.825	28.988
138.62	179968.	32.397	6423.47	51.598	43.172	-80.199	28.858	29.021
140.00	184237.	33.692	6517.97	51.473	43.178	-80.182	28.874	29.037
141.62	189291.	35.247	6619.00	51.362	43.189	-80.162	28.893	29.056
142.72	192705.	36.311	6627.43	51.348	43.197	-80.148	28.906	29.069
142.92	193322.	36.504	6625.50	51.348	43.199	-80.146	28.908	29.071
143.00	193554.	36.577	6624.80	51.349	43.199	-80.145	28.909	29.072

TABLE 8D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
-17.20	.000	.000	-47+100	-0.002	.003	.002	.000	.000	.000
-0.00	-0.043	.046	-47+066	-0.002	.003	.002	-0.043	.046	.034
10.00	.024	-0.007	-47+100	-0.000	.001	.000	-0.011	-0.022	.000
20.00	-3.512	.000	-38+532	-0.408	-0.000	1.004	.255	.201	-0.932
30.00	-7.731	.023	-28+530	-0.440	.006	1.000	.316	.197	-0.930
40.00	-12.381	.030	-18+530	-0.496	-0.008	1.000	.422	.168	-0.930
50.00	-17.791	-0.184	-8+534	-0.552	-0.028	.999	.454	-0.120	-0.934
59.70	-23.244	-0.605	-0.093	-0.562	-0.011	.004	.341	-0.605	.091
60.00	-23.412	-0.609	-0.086	-0.563	-0.013	-0.047	.341	-0.609	.084
70.00	-29.144	-0.774	-0.001	-0.595	-0.048	-0.000	.453	-0.774	-0.002
74.39	-31.785	-0.790	-0.005	-0.597	-0.028	.001	.536	-0.790	-0.002
80.00	-35.385	-0.616	-0.001	-0.675	-0.032	-0.002	.609	-0.616	-0.002
90.00	-42.552	-0.096	-0.002	-0.766	-0.043	.003	.654	-0.096	.001
100.00	-47.929	-0.008	-0.009	-0.501	-0.003	.001	.438	-0.008	.009
110.00	-52.816	-0.036	-0.017	-0.495	-0.003	.000	.442	-0.036	.017
120.00	-57.565	-0.063	-0.014	-0.468	-0.002	.000	.445	-0.063	.013
130.00	-62.348	-0.162	-0.010	-0.469	-0.002	-0.000	.405	-0.162	.009
132.00	-63.287	-0.167	-0.009	-0.470	-0.003	-0.000	.425	-0.167	.008
135.62	-63.819	-0.171	-0.007	-0.058	-0.001	-0.003	.107	-0.171	.007
138.62	-63.792	-0.170	-0.005	-0.012	-0.002	-0.000	.080	-0.170	.005
140.00	-63.789	-0.126	-0.004	-0.016	-0.055	-0.001	.077	-0.126	.004
141.62	-63.761	-0.075	-0.003	-0.015	-0.009	-0.001	.049	-0.075	.003
142.72	-63.755	-0.066	-0.004	-0.005	-0.013	.003	.043	-0.066	.004
142.92	-63.756	-0.063	-0.004	-0.008	-0.015	.004	.044	-0.063	.004
143.00	-63.757	-0.062	-0.005	-0.009	-0.016	.004	.045	-0.062	.005

TABLE 9D
APOLLO SOYUZ TEST PROJECT

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL)	DRAG (LB)	S-4B STAGE FLIGHT DATA			CENTRAL RANGE ANGLE (DEG)	PITCH ATT. CUMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
				LONGITUDINAL ACCELERATION (FT/SEC ²)	DYNAMIC PRESSURE (LB/FT ²)				
1)	143.00	306011.	9409.	748.	.869	16.	1.098	-63.712	-4.480
2)	144.32	306011.	8984.	643.	.876	14.	1.122	-63.712	-2.220
3)	147.72	305346.	180766.	456.	19.001	9.	1.184	-63.712	1.105
4)	150.72	303902.	194877.	323.	20.600	6.	1.239	-63.712	1.136
5)	154.92	301658.	229119.	198.	24.417	4.	1.317	-63.712	2.466
	160.00	298800.	229156.	115.	24.664	2.	1.413	-63.712	3.519
6)	166.31	288756.	229252.	58.	25.539	1.	1.534	-63.712	4.892
7)	166.62	288014.	229241.	56.	25.603	1.	1.540	-63.712	4.960
	170.00	284156.	229605.	39.	25.994	1.	1.606	-63.712	5.684
8)	171.75	283208.	230695.	32.	26.205	1.	1.641	-63.712	6.048
	180.00	278736.	230031.	24.	26.551	0.	1.806	-55.824	14.468
	190.00	273316.	230462.	8.	27.082	0.	2.011	-56.432	16.774
	200.00	2677901.	230078.	3.	27.631	0.	2.222	-57.575	17.398
	210.00	262494.	229580.	1.	28.139	0.	2.439	-58.556	18.008
	220.00	257089.	229406.	0.	28.709	0.	2.662	-59.664	18.460
	230.00	251697.	228951.	0.	29.266	0.	2.892	-60.616	19.043
	240.00	246304.	228852.	0.	29.894	0.	3.127	-61.780	19.371
	250.00	240921.	228527.	0.	30.519	0.	3.369	-62.737	19.769
	260.00	235538.	228521.	0.	31.215	0.	3.618	-63.815	20.027
	270.00	230141.	228832.	0.	31.991	0.	3.874	-65.106	19.965
	280.00	224747.	228984.	0.	32.780	0.	4.137	-66.145	20.174
	290.00	219347.	228794.	0.	33.559	0.	4.407	-67.304	20.185
	300.00	213950.	228554.	0.	34.370	0.	4.685	-68.426	20.176
	310.00	208563.	228688.	0.	35.278	0.	4.972	-69.414	20.270
	320.00	203175.	228522.	0.	36.187	0.	5.266	-70.538	20.160
	330.00	197790.	228707.	0.	37.203	0.	5.569	-71.588	20.058
	340.00	192388.	229070.	0.	38.308	0.	5.881	-72.917	19.693
	350.00	186990.	228736.	0.	39.357	0.	6.202	-73.996	19.400
	360.00	181598.	228554.	0.	40.493	0.	6.533	-75.003	19.243
	370.00	176208.	228307.	0.	41.680	0.	6.874	-76.084	18.978
	380.00	170808.	229072.	0.	43.148	0.	7.224	-77.261	18.609
	390.00	165411.	227948.	0.	44.338	0.	7.586	-78.392	18.162
	400.00	160026.	227916.	0.	45.823	0.	7.959	-79.378	17.921
	410.00	154641.	227853.	0.	47.405	0.	8.343	-80.529	17.448
	420.00	149258.	227799.	0.	49.104	0.	8.740	-81.677	16.950

1) S-IB/S-IVB Physical Separation
2) S-IVB Start Command
3) J-2 90 Percent Thrust
4) Termination of Ullage Burn

5) Jettison Ullage Rockets
6) Dynamic Pressure = 1 PSF
7) LES Jettison
8) IGM Initiation

TABLE 9D (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC ²)	DYNAMIC PRESSURE (LB/FT ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
430.00	143871.	228525.	0.	51.104	0.	9.148	-82.818	16.436
440.00	138469.	228730.	0.	53.146	0.	9.570	-84.044	15.806
450.00	133079.	227862.	0.	55.089	0.	10.006	-85.126	15.278
460.00	127693.	227808.	0.	57.399	0.	10.456	-86.244	14.703
470.00	122405.	227670.	0.	59.842	0.	10.921	-87.380	14.084
9) 470.25	122281.	205195.	0.	53.989	0.	10.933	-87.409	14.069
480.00	117759.	193111.	0.	52.761	0.	11.400	-88.515	13.538
490.00	113230.	193080.	0.	54.862	0.	11.894	-89.556	13.070
500.00	108701.	193051.	0.	57.139	0.	12.411	-90.591	12.605
510.00	104173.	193012.	0.	59.611	0.	12.924	-91.689	12.054
520.00	99646.	192971.	0.	62.306	0.	13.463	-92.845	11.391
530.00	95119.	192926.	0.	65.256	0.	14.018	-93.981	10.748
540.00	90593.	192877.	0.	68.499	0.	14.590	-95.147	10.085
550.00	86052.	193757.	0.	72.443	0.	15.181	-96.446	9.297
560.00	81512.	193038.	0.	76.193	0.	15.791	-97.609	8.566
570.00	76984.	192939.	0.	80.633	0.	16.421	-99.698	6.790
580.00	72459.	192801.	0.	85.608	0.	17.073	-99.529	7.460
10) 589.40	68209.	192611.	0.	90.852	0.	17.707	-99.437	7.960
590.00	68090.	11897.	0.	5.621	0.	17.748	-99.437	7.994
11) 599.40	68046.	0.	1.	-0.000	0.	18.393	-99.564	8.634

9) EMR Shift
 10) Guidance Cutoff Signal
 11) Orbit Insertion

TABLE 10D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)	
143.00	21102856.	7577.17	66.099	21099360.	198721.	328718.	2953.63	980.18	6908.60	
144.32	21106887.	7561.43	66.363	21103235.	200015.	337845.	2912.36	979.87	6908.93	
147.72	21117030.	7535.61	67.040	21112959.	203345.	361343.	2812.26	979.56	6922.21	
150.72	21125758.	7559.10	67.611	21121293.	206286.	382187.	2744.07	980.67	6974.84	
154.92	21137691.	7609.61	68.379	21132635.	210404.	411666.	2657.16	979.68	7062.99	
160.00	21151693.	7674.49	69.288	21145856.	215369.	447784.	2553.23	977.21	7171.04	
166.31	21168484.	7760.97	70.389	21161571.	221531.	493492.	2425.06	974.1d	7307.71	
166.62	21169292.	7765.48	70.442	21162323.	221833.	495763.	2418.84	974.01	7314.59	
170.00	21177969.	7815.95	71.014	21178373.	225117.	520576.	2351.68	972.11	7390.10	
171.75	21182394.	7842.92	71.306	21174458.	226818.	533543.	2317.07	971.09	7429.64	
180.00	21202584.	7972.30	72.580	21192917.	234799.	595603.	2163.14	962.04	7612.68	
190.00	21225813.	8132.15	73.870	21213740.	244355.	672786.	2001.50	949.13	7824.64	
200.00	21247775.	8303.52	75.111	21232943.	253781.	752119.	1836.92	936.09	8043.04	
210.00	21268487.	8485.92	76.305	21250514.	263077.	833667.	1675.06	923.36	8267.55	
220.00	21287967.	8679.60	77.443	21266444.	272250.	917491.	1510.60	911.36	8498.41	
230.00	21306234.	8883.93	78.530	21286723.	281306.	1003655.	1344.86	899.87	8735.32	
240.00	21323309.	9099.45	79.561	21293340.	290248.	1092220.	1178.41	888.65	8978.95	
250.00	21339214.	9325.80	80.542	21304284.	299080.	1183255.	1010.06	877.69	9229.30	
260.00	21353969.	9563.20	81.468	21313539.	307802.	1276829.	840.62	866.77	9486.67	
270.00	21367599.	9813.09	82.345	21321693.	316416.	1373020.	669.35	855.95	9752.74	
280.00	21380121.	10074.45	83.173	21326919.	324921.	1471910.	495.59	845.19	10026.70	
290.00	21391559.	10347.86	83.952	21331000.	333319.	1573582.	319.89	834.35	10309.21	
300.00	21401937.	10633.33	84.682	21333310.	341608.	1678124.	141.68	823.45	10600.45	
310.00	21411279.	10930.37	85.365	21333825.	349788.	1785619.	-39.11	812.40	10900.06	
320.00	21419615.	11239.77	85.999	213342521.	357856.	1896156.	-222.37	801.19	11208.97	
330.00	21426973.	11561.46	86.590	21329368.	365811.	2009829.	-408.81	789.85	11527.20	
340.00	21433385.	11897.56	87.133	21324338.	373052.	2126741.	-598.13	778.35	11856.99	
350.00	21438880.	12247.42	87.640	21317389.	381378.	2247005.	-792.31	766.86	12197.68	
360.00	21443483.	12610.69	88.105	21308480.	388988.	2370730.	-990.26	755.13	12549.05	
370.00	21447236.	12988.02	88.526	21297573.	396480.	2498025.	-1191.94	743.18	12911.84	
380.00	21450179.	13380.86	88.907	21284628.	403851.	2629010.	-1397.85	731.04	13287.55	
390.00	21452354.	13789.77	89.252	21269597.	411100.	2763822.	-1609.48	718.83	13676.65	
400.00	21453797.	14213.53	89.558	21252424.	418227.	2902584.	-1825.88	706.35	14078.05	
410.00	21454567.	14654.57	89.825	21233063.	425227.	3045433.	-2047.53	693.64	14494.24	
420.00	21454711.	15113.92	90.057	21211453.	432099.	3192522.	-2275.60	680.80	14926.10	

TABLE 10B (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)	
430.00	21454286.	15592.86	90.254	21187529.	438842.	3344012.	-2510.45	667.79	15374.94	
440.00	21453352.	16094.24	90.416	21161220.	445454.	3500089.	-2752.85	654.63	15043.54	
450.00	21451969.	16616.47	90.547	21132445.	451934.	3660943.	-3003.73	641.36	16330.14	
460.00	21450207.	17161.85	90.643	21101120.	458281.	3826762.	-3262.86	627.88	16037.12	
470.00	21448145.	17732.46	90.706	21067157.	464491.	3997762.	-3531.41	614.22	17366.41	
470.25	21448091.	17746.63	90.707	21066273.	464645.	4002105.	-3538.27	613.88	17379.49	
480.00	21445765.	18240.38	90.808	21030440.	470570.	4173725.	-3813.61	601.51	17827.11	
490.00	21443031.	18767.74	90.881	20990855.	476521.	4354365.	-4105.00	588.62	18303.84	
500.00	21440028.	19317.73	90.922	20948311.	482341.	4539868.	-4405.51	575.40	18799.87	
510.00	21436849.	19892.17	90.932	20902711.	468020.	4730434.	-4716.37	561.91	19316.79	
520.00	21433591.	20493.18	90.913	20853944.	493579.	4926282.	-5039.33	548.27	19856.36	
530.00	21430352.	21123.04	90.866	20801881.	498993.	5127647.	-5375.56	534.51	20420.59	
540.00	21427241.	21784.38	90.791	20746384.	504269.	5334787.	-5726.47	520.62	21011.80	
550.00	21424378.	22482.97	90.688	20687296.	509405.	5547996.	-6094.20	506.75	21635.34	
560.00	21421884.	23219.99	90.560	20624432.	514404.	5767606.	-6481.73	493.02	22291.52	
570.00	21419889.	23998.23	90.413	20557592.	519263.	5993947.	-6893.31	478.63	22981.91	
580.00	21418472.	24823.72	90.240	20486485.	523975.	6227384.	-7328.79	463.70	23712.67	
589.40	21417935.	25645.13	90.007	20415658.	528267.	6453666.	-7743.14	449.55	24444.11	
590.00	21417934.	25666.31	90.003	20411005.	528536.	6468340.	-7764.26	448.93	24459.64	
599.40	21417930.	25669.13	90.000	20336727.	532725.	6627872.	-8039.00	442.11	24373.82	

TABLE II-D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
143.00	295233.	6682.26	62.650	192384.	1517.	223939.	3019.02	13.27	5961.37
144.32	303796.	6664.28	62.940	196346.	1535.	231814.	2978.55	13.49	5961.60
147.72	325747.	6632.80	63.692	206299.	1581.	252070.	2880.61	14.62	5974.61
150.72	345121.	6651.74	64.351	214841.	1629.	270091.	2814.64	17.12	6026.87
154.92	372385.	6696.69	65.248	226486.	1705.	295587.	2730.98	18.18	6114.50
160.00	405592.	6755.43	66.310	240092.	1797.	326891.	2631.04	18.29	6221.99
166.31	447325.	6834.82	67.597	256315.	1914.	366604.	2507.95	18.67	6358.04
166.62	449390.	6839.01	67.660	257093.	1920.	368580.	2501.98	18.68	6364.89
170.00	471913.	6886.01	68.329	265428.	1983.	390187.	2437.60	18.69	6440.10
171.75	483651.	6911.27	68.671	269665.	2016.	401492.	2404.45	18.68	6479.50
180.00	539559.	7034.02	70.166	288872.	2160.	455711.	2257.44	14.52	6661.92
190.00	608651.	7188.07	71.681	310681.	2270.	523382.	2104.34	7.65	6873.14
200.00	679279.	7354.41	73.136	330957.	2314.	593197.	1950.62	1.15	7091.02
210.00	751538.	7532.47	74.530	349690.	2296.	665223.	1795.96	-4.52	7315.23
220.00	825529.	7722.39	75.856	366877.	2227.	739523.	1641.07	-8.94	7546.01
230.00	901395.	7923.51	77.117	382509.	2120.	816163.	1485.26	-12.32	7783.05
240.00	979121.	8136.35	78.308	396582.	1984.	895207.	1329.12	-14.88	8027.04
250.00	1058938.	8366.48	79.438	409086.	1825.	976727.	1171.48	-16.62	8277.98
260.00	1140916.	8596.10	80.500	420011.	1653.	1060791.	1013.16	-17.74	8536.16
270.00	1225176.	8844.58	81.500	429348.	1473.	1147481.	893.47	-18.15	8803.29
280.00	1311837.	9104.87	82.442	437075.	1292.	1236883.	691.73	-17.88	9078.54
290.00	1401024.	9377.52	83.323	443179.	1117.	1329082.	528.52	-17.04	9362.60
300.00	1492860.	9662.48	84.146	447640.	954.	1424166.	363.30	-15.59	9655.64
310.00	1587469.	9959.25	84.912	450438.	807.	1522223.	195.99	-13.60	9957.32
320.00	1684977.	10268.59	85.620	451554.	683.	1623344.	26.76	-11.07	10268.55
330.00	1785514.	10590.37	86.276	450965.	588.	1727626.	-145.12	-7.93	10589.37
340.00	1889218.	10926.71	86.878	448047.	526.	1835173.	-319.27	-4.18	10922.05
350.00	1996236.	11276.91	87.437	444566.	507.	1946104.	-491.08	0.42	11265.92
360.00	2106708.	11640.61	87.947	438684.	537.	2060528.	-679.21	5.60	11620.77
370.00	2220779.	12018.46	88.408	430972.	621.	2178559.	-863.83	11.42	11987.37
380.00	2338599.	12411.86	88.822	421397.	767.	2300320.	-1051.97	17.95	12367.19
390.00	2460339.	12821.37	89.195	409917.	983.	2425950.	-1245.09	25.40	12760.75
400.00	2586150.	13245.76	89.525	396483.	1278.	2555577.	-1442.22	33.53	13166.97
410.00	2716204.	13687.45	89.813	381658.	1657.	2689341.	-1643.81	42.49	13588.32
420.00	2850681.	14147.44	90.061	363590.	2130.	2827398.	-1850.94	52.40	14025.74

TABLE 11D (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
430.00	2989774.	14627.03	90.271	344021.	2708.	2969914.	-2063.96	63.32	14480.54
440.00	3133698.	15129.04	90.443	322290.	3401.	3117078.	-2283.51	75.35	14955.52
450.00	3282672.	15651.87	90.581	298327.	4219.	3269086.	-2510.54	88.58	15448.97
460.00	3436918.	16197.83	90.681	272057.	5176.	3426129.	-2744.73	102.96	15963.26
470.00	3596680.	16769.00	90.746	243405.	6283.	3588429.	-2987.18	118.63	16500.36
470.25	3600747.	16783.18	90.748	242657.	6312.	3592556.	-2993.39	119.04	16513.45
480.00	3761774.	17277.33	90.853	212257.	7551.	3755773.	-3244.05	135.31	16969.50
490.00	3931946.	17805.10	90.928	178498.	6993.	3927882.	-3509.13	153.17	17455.20
500.00	4107416.	18355.48	90.970	142049.	10619.	4104946.	-3782.24	172.17	17940.76
510.00	4288422.	18930.28	90.979	102823.	12441.	4287171.	-4064.54	192.46	18487.78
520.00	4475217.	19531.63	90.958	60722.	14473.	4474781.	-4357.68	214.30	19038.10
530.00	4668076.	20161.79	90.908	15631.	16732.	4668020.	-4662.76	237.83	19613.77
540.00	4867299.	20823.39	90.828	-32576.	19236.	4867152.	-4981.06	263.19	20217.15
550.00	5073223.	21522.20	90.718	-84041.	22043.	5072479.	-5314.57	290.74	20853.68
560.00	5286227.	22259.38	90.584	-130929.	25059.	5284342.	-5666.14	320.77	21523.75
570.00	5506692.	23037.76	90.431	-197426.	28425.	5503078.	-6039.99	352.73	22229.09
580.00	5735044.	23883.35	90.250	-259803.	32121.	5729066.	-6435.71	386.95	22975.89
589.40	5957316.	24684.82	90.010	-322052.	35918.	5948496.	-6810.57	428.29	23722.97
590.00	5971761.	24705.99	90.003	-326145.	36171.	5962738.	-6829.97	423.01	23739.39
599.40	6198071.	24708.48	90.000	-391555.	40249.	6185559.	-7086.51	444.46	23666.28

TABLE 12D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEOETIC LATITUDE (DEG)
143.00	193575.	36.584	6624.76	51.349	43.199	-80.145	28.909	29.072
144.32	197622.	37.862	6608.94	51.359	43.210	-80.128	28.925	29.088
147.72	207807.	41.152	6531.87	51.375	43.244	-80.085	28.964	29.128
150.72	216571.	44.070	6555.06	51.353	43.286	-80.047	29.000	29.163
154.92	228557.	48.200	6594.07	51.288	43.323	-79.993	29.050	29.213
160.00	242623.	53.266	6651.76	51.201	43.355	-79.927	29.111	29.275
166.31	259495.	59.686	6729.92	51.096	43.399	-79.843	29.189	29.353
166.62	260307.	60.005	6734.04	51.091	43.401	-79.839	29.193	29.357
170.00	269028.	63.495	6780.43	51.034	43.424	-79.793	29.235	29.399
171.75	273476.	65.320	6805.37	51.004	43.435	-79.769	29.257	29.421
180.00	293777.	74.066	6926.91	50.843	43.454	-79.654	29.363	29.527
190.00	317144.	84.966	7079.81	50.657	43.467	-79.511	29.494	29.660
200.00	339250.	96.195	7245.09	50.482	43.489	-79.363	29.630	29.796
210.00	360109.	107.766	7422.14	50.322	43.523	-79.210	29.770	29.936
220.00	379742.	119.690	7611.11	50.179	43.572	-79.052	29.914	30.080
230.00	398166.	131.978	7811.31	50.051	43.633	-78.890	30.062	30.229
240.00	415404.	144.643	8023.28	49.937	43.705	-78.721	30.215	30.382
250.00	431476.	157.697	8246.58	49.835	43.787	-78.547	30.372	30.540
260.00	446404.	171.153	8481.41	49.744	43.877	-78.367	30.533	30.702
270.00	460214.	185.026	8729.13	49.665	43.975	-78.181	30.700	30.869
280.00	472921.	199.330	8988.69	49.596	44.082	-77.988	30.871	31.041
290.00	484550.	214.083	9260.62	49.538	44.195	-77.789	31.047	31.217
300.00	495125.	229.299	9544.88	49.490	44.316	-77.582	31.229	31.399
310.00	504670.	244.995	9840.96	49.453	44.444	-77.368	31.415	31.587
320.00	513217.	261.188	10149.61	49.426	44.578	-77.146	31.608	31.780
330.00	520792.	277.894	10470.72	49.409	44.720	-76.917	31.806	31.978
340.00	527428.	295.135	10806.37	49.402	44.868	-76.678	32.009	32.183
350.00	533155.	312.930	11155.88	49.407	45.025	-76.431	32.219	32.393
360.00	537997.	331.301	11518.88	49.422	45.190	-76.175	32.435	32.609
370.00	541997.	350.268	11896.61	49.447	45.361	-75.908	32.657	32.832
380.00	545196.	369.854	12288.69	49.484	45.541	-75.632	32.886	33.062
390.00	547635.	380.084	12697.45	49.532	45.729	-75.345	33.122	33.298
400.00	549351.	410.983	13121.67	49.592	45.925	-75.046	33.364	33.541
410.00	550403.	432.575	13561.97	49.663	46.131	-74.736	33.614	33.791
420.00	550839.	454.890	14021.14	49.747	46.346	-74.413	33.871	34.049

TABLE 12D (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE

S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS, EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
430.00	550714.	477.957	14499.87	49.843	46.571	-74.077	34.136	34.314
440.00	550091.	501.811	15000.99	49.953	46.806	-73.728	34.408	34.588
450.00	549030.	526.488	15522.91	50.076	47.053	-73.363	34.689	34.869
460.00	547600.	552.022	16067.91	50.213	47.311	-72.983	34.978	35.159
470.00	545882.	578.453	16638.08	50.366	47.581	-72.586	35.275	35.457
470.25	545836.	579.125	16652.24	50.370	47.588	-72.576	35.283	35.465
480.00	543856.	605.753	17145.38	50.547	47.865	-72.174	35.581	35.764
490.00	541487.	633.885	17672.08	50.742	48.161	-71.744	35.895	36.078
500.00	538858.	662.884	18221.35	50.951	48.470	-71.298	36.216	36.400
510.00	536065.	692.788	18795.00	51.176	48.792	-70.834	36.545	36.730
520.00	533204.	723.640	19395.15	51.416	49.128	-70.350	36.883	37.068
530.00	530373.	755.484	20024.06	51.674	49.480	-69.846	37.229	37.414
540.00	527681.	788.369	20684.36	51.950	49.849	-69.321	37.583	37.769
550.00	525250.	822.349	21381.81	52.246	50.237	-68.772	37.947	38.133
560.00	523199.	857.487	22117.57	52.562	50.644	-68.198	38.319	38.507
570.00	521661.	893.843	22894.47	52.900	51.071	-67.598	38.702	38.890
580.00	520714.	931.490	23718.52	53.261	51.519	-66.969	39.094	39.282
589.40	520631.	968.119	24538.49	53.621	51.961	-66.350	39.472	39.661
590.00	520659.	970.499	24559.56	53.647	51.990	-66.309	39.496	39.685
599.40	521114.	1007.792	24560.52	54.001	52.450	-65.671	39.877	40.066

TABLE 13D
APOLLO SOYUZ TEST PROJECT
TYPICAL PLANAR CASE
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
143.00	+63.757	-0.062	0.005	+0.009	-0.016	-0.004	+0.045	-0.062	.005
144.32	-63.817	.037	.018	-0.073	+0.146	+0.016	+0.105	+0.37	.018
147.72	+64.101	1.135	.126	+0.017	+0.286	+0.076	+0.388	+1.136	.123
150.72	+63.804	.865	.308	+0.159	+0.337	+0.010	+0.090	+0.866	.308
154.92	+63.451	-0.317	-0.035	+0.002	+0.101	+0.175	+0.261	+0.317	-0.036
160.00	+63.574	-0.269	-0.115	+0.018	+0.020	+0.056	+0.138	+0.269	-0.115
166.31	+63.632	-0.346	-0.260	+0.000	+0.021	+0.027	+0.081	+0.346	-0.260
166.62	+63.634	-0.353	-0.253	+0.006	+0.021	+0.020	+0.079	+0.353	-0.253
170.00	+63.657	-0.409	-0.293	+0.009	+0.009	+0.042	+0.056	+0.409	-0.294
171.75	+63.675	-0.419	-0.391	+0.011	+0.003	+0.069	+0.039	+0.419	-0.391
180.00	+56.946	-1.970	.363	.974	.076	.073	-1.122	+0.539	.397
190.00	+56.388	-1.827	-0.560	-0.086	+0.005	+0.014	+0.46	+0.460	-0.561
200.00	+57.455	-1.765	-0.742	+0.139	+0.010	+0.035	+0.123	+0.470	-0.745
210.00	+58.484	-1.557	-0.352	+0.096	+0.020	+0.037	+0.074	+0.493	-0.354
220.00	+59.609	-1.361	-0.035	+0.104	+0.015	+0.033	+0.056	+0.492	-0.036
230.00	+60.544	-1.240	.313	-0.097	+0.011	+0.033	+0.070	+0.498	.312
240.00	+61.670	-1.124	.605	+0.139	+0.014	+0.022	+0.108	+0.506	.603
250.00	+62.665	-1.053	.648	+0.097	+0.006	+0.059	+0.069	+0.506	.647
260.00	+63.727	-0.991	.034	+0.113	+0.007	+0.063	+0.087	+0.513	.033
270.00	+65.049	-0.904	-0.647	+0.111	+0.005	+0.062	+0.059	+0.513	-0.648
280.00	+66.065	-0.873	-0.443	+0.106	+0.004	+0.031	+0.082	+0.523	-0.444
290.00	+67.225	-0.827	-0.154	+0.114	+0.004	+0.029	+0.084	+0.530	-0.155
300.00	+68.355	-0.792	.913	+0.117	+0.003	+0.029	+0.070	+0.536	.143
310.00	+69.331	-0.782	.482	+0.108	+0.003	+0.031	+0.080	+0.548	.482
320.00	+70.460	-0.750	.679	+0.111	+0.002	+0.030	+0.075	+0.553	.778
330.00	+71.525	-0.731	.454	+0.101	+0.001	+0.050	+0.060	+0.559	.454
340.00	+72.803	-0.682	-0.124	+0.145	+0.007	+0.063	+0.115	+0.572	-0.125
350.00	+73.971	-0.660	-0.671	+0.116	+0.001	+0.054	+0.027	+0.574	-0.671
360.00	+74.979	-0.649	-0.566	+0.106	+0.001	+0.021	+0.027	+0.582	-0.566
370.00	+76.056	-0.630	-0.360	+0.109	+0.002	+0.020	+0.030	+0.592	-0.360
380.00	+77.200	-0.601	-0.173	+0.135	+0.006	+0.013	+0.062	+0.604	-0.174
390.00	+78.391	-0.573	.000	+0.092	+0.001	+0.025	+0.001	+0.607	.000
400.00	+79.344	-0.571	.241	+0.112	+0.003	+0.019	+0.033	+0.622	.241
410.00	+80.495	-0.542	.924	+0.116	+0.003	+0.018	+0.032	+0.630	.424
420.00	+81.645	-0.516	.607	+0.114	+0.003	+0.018	+0.029	+0.640	.607

TABLE 13D (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL PLANAR CASE
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
430.00	-82.784	-0.490	-0.791	-0.014	-0.002	-0.018	-0.030	-0.650	-0.791
440.00	-84.012	-0.453	-0.828	-0.017	-0.003	-0.054	-0.028	-0.660	-0.828
450.00	-85.107	-0.431	-0.313	-0.017	-0.002	-0.051	-0.017	-0.665	-0.312
460.00	-86.224	-0.407	-0.212	-0.014	-0.003	-0.053	-0.021	-0.674	-0.212
470.00	-87.364	-0.380	-0.744	-0.014	-0.003	-0.053	-0.020	-0.682	-0.744
470.25	-87.392	-0.380	-0.750	-0.014	-0.003	-0.026	-0.021	-0.682	-0.750
480.00	-88.506	-0.359	-0.339	-0.018	-0.002	-0.044	-0.012	-0.690	-0.339
490.00	-89.554	-0.346	-0.107	-0.010	-0.000	-0.046	-0.002	-0.697	-0.107
500.00	-90.577	-0.339	-0.558	-0.018	-0.002	-0.043	-0.011	-0.709	-0.558
510.00	-91.661	-0.320	-0.559	-0.014	-0.004	-0.061	-0.024	-0.719	-0.559
520.00	-92.832	-0.291	-0.063	-0.012	-0.003	-0.061	-0.013	-0.724	-0.063
530.00	-93.970	-0.262	-0.679	-0.016	-0.003	-0.062	-0.015	-0.730	-0.679
540.00	-95.134	-0.229	-0.284	-0.017	-0.003	-0.044	-0.015	-0.739	-0.284
550.00	-96.411	-0.173	-0.125	-0.019	-0.005	-0.038	-0.034	-0.750	-0.125
560.00	-97.625	-0.151	-0.547	-0.011	-0.004	-0.047	-0.020	-0.747	-0.547
570.00	-99.874	-0.178	-0.248	-0.003	-0.003	-0.017	-0.170	-0.763	-0.247
580.00	-99.674	-0.153	-0.113	-0.015	-0.003	-0.015	-0.145	-0.770	-0.112
589.40	-99.564	-0.129	-0.035	-0.000	-0.001	-0.018	-0.127	-0.772	-0.035
590.00	-99.565	-0.130	-0.046	-0.000	-0.001	-0.018	-0.127	-0.772	-0.046
599.40	-99.564	-0.135	-0.218	-0.000	-0.000	-0.018	-0.125	-0.777	-0.219

APPENDIX E

**TRAJECTORY LISTING FOR A
TYPICAL LAUNCH WINDOW CLOSING
METRIC UNITS**

TABLE 1E

APOLLO SOYUZ TEST PROJECT
 S-IB STAGE END CONDITIONS OF FLIGHT
 TYPICAL LAUNCH WINDOW CLOSING

Flight Time: OECO + 1.379 seconds	143.00	(sec)
Radius:	6432092.	(m)
Altitude:	58958.	(m)
Space Fixed Velocity:	2279.92	(m/s)
Space Fixed Path Angle:	65.826	(deg)
Space Fixed Flight Azimuth:	45.558	(deg)
Earth Fixed Flight Azimuth:	36.423	(deg)
Geocentric Declination:	28.955	(deg)
Geodetic Latitude:	29.118	(deg)
Longitude: (Pos. East)	-80.207	(deg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	6431104.	(m)
Ys	=	63956.	(m)
Zs	=	92823.	(m)
Xs	=	900.65	(m/s)
Ys	=	330.65	(m/s)
Zs	=	2068.22	(m/s)

VEHICLE ATTITUDE AND ATTITUDE RATE

Pitch Attitude Angle:	-63.756	(deg)
Yaw Attitude Angle:	- 0.060	(deg)
Roll Attitude Angle:	0.005	(deg)
Pitch Rate:	- 0.008	(deg/s)
Yaw Rate:	0.017	(deg/s)
Roll Rate:	0.004	(deg/s)

TABLE 2E

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW CLOSING

Flight Time: Guidance Cutoff Signal	590.64	(sec)
Radius:	6528187.	(m)
Altitude:	158925.	(m)
Space Fixed Velocity:	7811.00	(m/s)
Space Fixed Flight Path Angle:	90.009	(deg)
Space Fixed Flight Azimuth:	54.355	(deg)
Earth Fixed Flight Azimuth:	52.738	(deg)
Geocentric Declination:	40.117	(deg)
Geodetic Latitude:	40.306	(deg)
Longitude: (Pos. East)	-67.027	(deg)
Inclination:	51.577	(deg)
Descending Node Argument:	154.192	(deg)
Inertial Range Angle:	17.650	(deg)
Mass:	30685.	(kg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	6224807.	(m)
Ys	=	297719.	(m)
Zs	=	1944316.	(m)
Xs	=	- 2354.61	(m/s)
Ys	=	1169.10	(m/s)
Zs	=	7355.32	(m/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-100.090	(deg)
Yaw Attitude Angle	=	14.613	(deg)
Roll Attitude Angle	=	0.844	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	139.71	(km)
*Apogee Altitude	=	150.27	(km)
Eccentricity	=	.00080	
Semi-Major Axis	=	6523.15	(km)
True Anomaly	=	191.68	(deg)
Period	=	87.39	(min)

*Referenced to Equatorial Radius (6378.16 km)

TABLE 2E (CONTINUED)

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW CLOSING

Flight Time: Orbit Insertion	600.64	(sec)
Radius:	6528185.	(m)
Altitude:	159070.	(m)
Space Fixed Velocity:	7818.36	(m/s)
Space Fixed Flight Path Angle:	90.000	(deg)
Space Fixed Flight Azimuth:	54.836	(deg)
Earth Fixed Flight Azimuth:	53.249	(deg)
Geocentric Declination:	40.514	(deg)
Geodetic Latitude:	40.704	(deg)
Longitude: (Pos. East)	-66.336	(deg)
Inclination:	51.574	(deg)
Descending Node Argument:	154.186	(deg)
Inertial Range Angle:	18.337	(deg)
Mass:	30611.	(kg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	6200803.	(m)
Ys	=	309407.	(m)
Zs	=	2017798.	(m)
Xs	=	- 2444.85	(m/s)
Ys	=	1166.71	(m/s)
Zs	=	7334.05	(m/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-100.091	(deg)
Yaw Attitude Angle	=	14.614	(deg)
Roll Attitude Angle	=	0.267	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	149.91	(km)
*Apogee Altitude	=	165.47	(km)
Eccentricity	=	.00118	
Semi-Major Axis	=	6535.86	(km)
True Anomaly	=	359.59	(deg)
Period	=	87.64	(min)

*Referenced to Equatorial Radius (6378.16 km)

TABLE 3E
 APOLLO SOYUZ TEST PROJECT
 SEQUENCE OF EVENTS
 TYPICAL LAUNCH WINDOW CLOSING

FLIGHT TIME (SEC)	PROGRAM TIME (SEC)	
-17.20	---	Guidance Reference Release (GRR)
0.00	---	First Motion
0.20	(0.00) ₁	Lift-off Signal; Initiate Time Base One
59.63	---	Mach One
74.35	---	Maximum Dynamic Pressure
132.00	(131.80) ₁	Tilt Arrest
135.62	(0.00) ₂	Level Sensor Activation; Initiate Time Base Two
138.62	(3.00) ₂	Inboard Engine Cutoff (IECO)
141.62	(0.00) ₃	Outboard Engine Cutoff (OECO); Initiate Time Base Three
142.72	(1.10) ₃	Ignite Ullage Rockets
142.92	(1.30) ₃	Separation Signal
143.00	---	S-IB/S-IVB Physical Separation
144.32	(2.70) ₃	S-IVB J-2 Engine Start Command
147.72	---	90 Percent J-2 Thrust Level
150.72	---	Termination of Ullage Burn
154.92	(13.30) ₃	Jettison Ullage Rockets
166.48	---	Dynamic Pressure = 1 PSF
166.62	---	LES Jettison
171.75	(30.00) ₃	IGM Initiation
469.72	(328.10) ₃	EMR Shift Command
590.64	---	Guidance Cutoff Signal (GCS)
590.84	(0.00) ₄	Inertial Attitude Freeze; Initiate Time Base Four
600.64	---	Orbit Insertion (OI)

TABLE 4E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING

S-IB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (IN)	DRAG (N)	LONGITUDINAL ACCELERATION (M/SEC ²)	DYNAMIC PRESSURE (N/M ²)	A+H+I (KG-M/M ² -RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1) -17.20	594674	0	0	0.000	0	0	0.00	N/A
2) .00	588243	7132169	262	12.145	1	0	0.00	N/A
10.00	559814	7344526	11424	13.120	510	2383	.09	-1.764
20.00	531215	7457508	44002	13.976	2500	49120	.20	-1.317
30.00	502474	7561086	94858	14.878	6579	315439	.33	-.668
40.00	473691	7680431	155632	15.906	12926	1229284	.51	-.091
50.00	444882	7821200	242032	17.055	20890	3536976	.73	.163
3) 59.63	417132	7944277	661073	17.478	28288	8183360	1.00	.296
60.00	416079	7948279	678316	17.490	28504	8402792	1.01	.298
70.00	387128	8082234	659812	19.188	32773	15860500	1.37	.192
4) 74.35	374535	8133824	575715	20.193	33362	20046000	1.57	.866
80.00	358161	8187070	482493	21.516	32243	26136954	1.86	.140
90.00	329300	8244775	314479	24.082	24283	37539568	2.40	-.251
100.00	300560	8261618	173415	26.911	15258	47494260	2.95	-.503
110.00	271886	8249359	87598	30.021	8559	54961498	3.56	-1.280
120.00	243314	8215089	24192	33.668	4385	59959664	4.23	-2.077
130.00	214892	8161845	-4980	38.009	2160	63058061	5.02	-3.055
5) 132.00	209239	8147192	-7852	38.979	1875	63514673	5.21	-3.261
6) 135.62	199002	8116480	-14110	40.859	1471	64237061	5.64	-2.545
7) 138.62	190566	8078692	-21819	42.509	1188	64759230	6.05	-1.634
140.0G	188213	4128247	-21633	22.049	1047	64959823	6.18	-1.290
8) 141.62	185432	3572512	-22413	19.387	897	65227837	6.32	-.805
9) 142.72	184799	247074	-20739	1.449	793	65379365	6.37	-.515
10) 142.92	184684	255663	-20333	1.495	774	65400090	6.37	-.467
11) 143.00	184671	242844	-20183	1.424	767	65407736	6.38	-.449

- 1) Guidance Reference Release
- 2) First Motion
- 3) Mach One
- 4) Maximum Dynamic Pressure
- 5) Tilt Arrest
- 6) LSA, Initiate Time Base Two
- 7) IEKO
- 8) OECO, Initiate Time Base Three
- 9) Ignite Ullage Rockets
- 10) Separation Signal
- 11) S-IB/S-IVB Physical Separation

TABLE 5B
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
-17.20	6373379.	408.57	90.000	6373353.	10597.	-14509.	0.00	329.93	240.98
0.00	6373379.	408.57	90.000	6373349.	16271.	-10363.	-0.45	329.79	241.18
10.00	6373520.	409.52	85.853	6373485.	19568.	-7950.	20.91	329.60	241.31
20.00	6373996.	415.89	80.725	6373952.	22863.	-5527.	66.06	329.48	245.04
30.00	6374887.	433.78	74.958	6374833.	26158.	-3015.	111.35	329.50	259.23
40.00	6376274.	466.82	69.138	6376206.	29457.	-302.	164.73	330.53	285.55
50.00	6378238.	518.35	63.933	6378154.	32772.	2747.	225.92	332.53	327.21
59.63	6380741.	585.96	60.170	6380637.	35984.	6164.	289.23	334.16	384.76
60.00	6380848.	588.77	60.065	6380743.	36106.	6305.	291.54	334.21	387.25
70.00	6384110.	677.20	57.897	6383979.	39460.	10553.	357.05	336.73	466.61
74.35	6385743.	724.35	57.280	6385599.	40926.	12674.	388.37	337.57	509.80
80.00	6388078.	794.29	56.786	6387915.	42837.	15734.	431.40	338.47	574.65
90.00	6392831.	943.02	56.846	6392625.	46219.	22162.	510.92	337.50	717.24
100.00	6398398.	1127.26	57.944	6398134.	49587.	36213.	591.47	336.36	898.75
110.00	6404809.	1348.61	59.495	6404464.	52948.	40263.	674.49	335.74	1117.80
120.00	6412088.	1608.49	61.338	6411624.	56301.	52711.	757.29	334.88	1378.99
130.00	6420240.	1914.16	63.345	6419603.	59643.	68008.	837.81	333.23	1688.50
132.00	6421975.	1981.32	63.759	6421294.	60309.	71453.	853.46	332.80	1756.84
135.62	6425208.	2108.64	64.492	6424440.	61514.	78055.	882.06	331.95	1886.30
138.62	6427976.	2219.73	65.021	6427125.	62508.	83882.	908.19	331.23	1998.17
140.00	6429269.	2250.36	65.267	6428377.	62964.	86655.	911.05	330.98	2030.90
141.62	6430801.	2278.33	65.557	6429858.	63501.	89981.	910.76	330.77	2062.01
142.72	6431835.	2280.60	65.771	6430856.	63865.	92254.	903.12	330.67	2067.89
142.92	6432022.	2280.11	65.811	6431037.	63931.	92668.	901.33	330.65	2068.13
143.00	6432092.	2279.92	65.826	6431164.	63956.	92823.	900.65	330.65	2068.22

TABLE 6E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	***** EARTH FIXED *****			***** EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS *****						
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
-17.20	90.	.00	N/A	90.	-0.	-0.	-0.00	-0.00	-0.00	-0.00
-0.00	90.	.00	N/A	90.	-0.	0.	-0.00	-0.00	-0.00	.00
10.00	231.	29.62	-400	231.	-1.	0.	29.62	-0.15	-0.02	
20.00	707.	67.13	3.153	707.	-3.	9.	67.04	0.29	3.52	
30.00	1602.	113.96	8.940	1599.	-7.	105.	112.61	0.36	17.45	
40.00	3013.	171.92	14.765	2987.	-7.	399.	166.34	0.54	43.45	
50.00	5057.	243.18	20.508	4952.	8.	1024.	227.95	0.36	84.69	
59.63	7747.	324.39	26.032	7457.	38.	2102.	291.75	0.79	141.76	
60.00	7865.	327.57	26.242	7564.	39.	2154.	294.08	0.85	144.23	
70.00	11534.	423.74	31.862	10829.	89.	3970.	360.25	6.18	223.02	
74.35	13441.	473.67	34.249	12463.	117.	5031.	391.92	6.96	265.92	
80.00	16252.	546.66	37.261	14801.	159.	6712.	435.47	7.78	330.37	
90.00	22291.	699.47	42.497	19557.	234.	10692.	516.00	6.77	472.18	
100.00	29944.	805.39	47.488	25125.	295.	16288.	598.10	5.77	652.80	
110.00	39551.	1106.75	51.811	31530.	352.	23875.	682.98	5.51	870.87	
120.00	51480.	1367.16	55.645	38786.	406.	33848.	768.10	5.32	1130.98	
130.00	66149.	1672.35	59.104	46887.	457.	46659.	851.51	4.76	1439.33	
132.00	69451.	1739.38	59.758	48604.	466.	49606.	867.81	4.60	1507.42	
135.62	75779.	1866.49	60.889	51806.	482.	55303.	897.67	4.31	1636.44	
138.62	81366.	1977.55	61.706	54539.	495.	60379.	924.91	4.08	1747.92	
140.00	84027.	2007.93	62.037	55015.	501.	62808.	928.18	4.03	1780.52	
141.62	87214.	2035.53	62.410	57324.	507.	65727.	928.34	4.06	1811.50	
142.72	89391.	2037.35	62.653	58342.	512.	67725.	920.92	4.10	1817.33	
142.92	89786.	2036.77	62.697	50526.	513.	68089.	919.16	4.11	1817.57	
143.00	89935.	2036.55	62.713	50595.	513.	68225.	918.49	4.11	1817.64	

TABLE 7E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED (DEG)	AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
-17.20	0.000	0.000	0.00	90.000	N/A	-80.621	28.466	28.627
0.00	0.900	0.000	1.19	90.000	N/A	-80.621	28.466	28.627
10.00	2.31	0.001	29.65	89.978	39.320	-80.621	28.466	28.627
20.00	7.07	0.012	67.12	89.553	29.844	-80.621	28.466	28.627
30.00	1.599	0.109	113.66	88.001	34.383	-80.620	28.467	28.628
40.00	2.987	0.405	170.77	85.368	36.489	-80.619	28.469	28.630
50.00	4.952	1.035	240.16	81.651	37.478	-80.615	28.473	28.635
59.63	7.457	2.117	318.48	77.159	37.482	-80.608	28.481	28.643
60.00	7.564	2.169	321.51	76.981	37.478	-80.608	28.481	28.643
70.00	10.830	3.989	413.26	72.001	37.584	-80.596	28.494	28.656
74.35	12.465	5.050	461.16	69.697	37.514	-80.590	28.502	28.664
80.00	14.805	6.731	534.37	66.687	37.384	-80.579	28.514	28.676
90.00	19.566	10.706	695.18	61.400	36.890	-80.555	28.542	28.704
100.00	25.146	16.283	879.84	56.745	36.610	-80.520	28.583	28.745
110.00	31.575	23.830	1091.59	52.982	36.500	-80.474	28.637	28.799
120.00	38.876	33.733	1345.96	49.963	36.446	-80.414	28.709	28.871
130.00	47.057	46.425	1652.60	47.539	36.412	-80.337	28.801	28.963
132.00	48.798	49.341	1724.61	47.116	36.407	-80.319	28.822	28.984
135.62	52.045	54.975	1848.76	46.396	36.402	-80.285	28.862	29.025
138.62	54.824	59.990	1959.22	45.850	36.402	-80.254	28.899	29.062
140.00	56.123	62.389	1988.15	45.705	36.406	-80.240	28.916	29.079
141.62	57.661	65.270	2018.83	45.576	36.414	-80.222	28.937	29.100
142.72	58.699	67.242	2021.89	45.558	36.421	-80.210	28.951	29.114
142.92	58.887	67.640	2021.43	45.558	36.422	-80.208	28.954	29.117
143.00	58.958	67.735	2021.26	45.558	36.423	-80.207	28.955	29.118

TABLE 8E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
17.20	.000	.000	-53.856	.002	.003	.002	.000	.000	.000
.00	-.037	.051	-53.822	.002	.003	.002	-.037	.051	.034
10.00	-.024	-.004	-53.856	.000	.001	.000	-.011	-.022	.000
20.00	-3.512	.004	-45.289	.408	.000	1.004	.227	.232	.933
30.00	-7.720	.032	-35.285	.439	.007	1.000	.288	.242	.929
40.00	-12.377	.038	-25.285	.497	.009	1.000	.400	.225	.928
50.00	-17.812	-.202	-15.288	.555	.032	.999	.450	-.089	.933
59.63	-23.265	-.673	-5.662	.557	.011	1.000	.342	.645	.941
60.00	-23.470	-.679	-5.296	.561	.018	1.000	.344	.650	.941
70.00	-29.229	-.870	-.006	.598	.051	.003	.369	.870	.009
74.35	-31.840	-.883	-.001	.595	.030	.001	.456	.883	.003
80.00	-35.444	-.690	-.002	.671	.037	.001	.550	.690	.005
90.00	-42.558	-.104	-.002	.762	.048	.003	.648	.104	.001
100.00	-47.927	-.006	-.009	.501	.004	.001	.440	.006	.009
110.00	-52.813	-.027	.017	.494	.003	.000	.444	-.027	.017
120.00	-57.563	-.058	.014	.468	.002	.000	.447	-.058	.013
130.00	-62.348	-.159	.010	.469	.003	.000	.406	-.160	.009
132.00	-63.287	-.165	-.009	.470	.003	.000	.425	-.166	.008
135.62	-63.819	-.170	-.007	.058	.001	-.003	-.107	-.170	.007
138.62	-63.792	-.169	-.005	.012	.002	-.000	-.080	-.169	.005
140.00	-63.789	-.124	-.004	.016	.055	-.001	-.076	-.124	.004
141.62	-63.761	-.073	-.003	.015	.009	-.001	-.049	-.073	.003
142.72	-63.754	-.064	-.004	.004	.014	-.003	-.042	-.064	.004
142.92	-63.755	-.061	-.004	.007	.016	-.004	-.043	-.061	.004
143.00	-63.756	-.060	-.005	.008	.017	-.004	-.043	-.060	.005

TABLE 9E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	S-4B STAGE FLIGHT DATA			CENTRAL PRESSURE (N/M ²)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
				LONGITUDINAL ACCELERATION (M/S ²)	DYNAMIC PRESSURE	RANGE ANGLE (DEG)			
1)	143.00	138804.	40075.	3352.	.265	767.	1.069	-63.712	-4.448
2)	144.32	138804.	39965.	2887.	.267	657.	1.092	-63.712	-1.160
3)	147.72	138502.	804087.	2075.	5.791	436.	1.152	-63.712	.282
4)	150.72	137848.	866856.	1473.	6.279	310.	1.206	-63.712	1.316
5)	154.92	136830.	1019172.	903.	7.442	191.	1.282	-63.712	2.582
	160.00	135533.	1019337.	525.	7.518	105.	1.376	-63.712	3.615
6)	166.48	130798.	1019738.	263.	7.795	48.	1.498	-63.712	5.019
7)	166.62	130641.	1019713.	259.	7.804	47.	1.501	-63.712	5.051
	170.00	128891.	1021335.	181.	7.923	31.	1.565	-63.712	5.771
8)	171.75	128461.	1026181.	149.	7.987	25.	1.599	-63.712	6.132
	180.00	126432.	1023228.	111.	8.093	8.	1.761	-55.888	14.552
	190.00	123974.	1023368.	37.	8.255	2.	1.963	-56.481	16.792
	200.00	121518.	1023438.	13.	8.422	1.	2.170	-57.543	17.490
	210.00	119065.	1021221.	5.	8.577	0.	2.384	-58.445	18.181
	220.00	116614.	1020447.	2.	8.751	0.	2.604	-59.483	18.723
	230.00	114168.	1018423.	1.	8.920	0.	2.830	-60.371	19.395
	240.00	111721.	1017984.	1.	9.112	0.	3.062	-61.479	19.772
	250.00	109280.	1016538.	0.	9.302	0.	3.301	-62.383	20.208
	260.00	106838.	1016512.	0.	9.514	0.	3.547	-63.415	20.507
	270.00	104390.	1017894.	0.	9.751	0.	3.800	-64.668	20.474
	280.00	101944.	1018571.	0.	9.991	0.	4.060	-65.673	20.691
	290.00	99494.	1017727.	0.	10.229	0.	4.328	-66.802	20.698
	300.00	97046.	1016660.	0.	10.476	0.	4.604	-67.896	20.708
	310.00	94602.	1017254.	0.	10.753	0.	4.888	-68.859	20.872
	320.00	92159.	1016515.	0.	11.030	0.	5.180	-69.967	20.825
	330.00	89716.	1017338.	0.	11.339	0.	5.480	-71.005	20.745
	340.00	87266.	1018955.	0.	11.676	0.	5.790	-72.332	20.343
	350.00	84817.	1017470.	0.	11.996	0.	6.109	-73.408	20.015
	360.00	82372.	1016661.	0.	12.342	0.	6.438	-74.416	19.804
	370.00	79927.	1015560.	0.	12.706	0.	6.776	-75.501	19.584
	380.00	77477.	1018962.	0.	13.152	0.	7.125	-76.690	19.256
	390.00	75029.	1013965.	0.	13.514	0.	7.485	-77.835	18.844
	400.00	72587.	1013822.	0.	13.967	0.	7.856	-78.837	18.516
	410.00	70144.	1013540.	0.	14.449	0.	8.238	-80.007	17.944
	420.00	67702.	1013301.	0.	14.967	0.	8.633	-81.174	17.387

1) S-IB/S-IVB Physical Separation 5) Jettison Ullage Rockets
 2) S-IVB Start Command 6) Dynamic Pressure = 1 PSF
 3) J-2 90 Percent Thrust 7) LES Jettison
 4) Termination of Ullage Burn 8) IGM Initiation

TABLE 9E (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (KG)	THRUST (TOTAL) (N)	DRAG (N)	LONGITUDINAL ACCELERATION (M/S ²)	DYNAMIC PRESSURE (N/M ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
430.00	65259.	1016529.	0.	15.577	0.	9.040	-82.339	16.874
440.00	62809.	1017444.	0.	16.199	0.	9.460	-83.595	16.240
450.00	60364.	1013580.	0.	16.791	0.	9.894	-84.710	15.723
460.00	57920.	1013339.	0.	17.495	0.	10.342	-85.871	15.152
470.00	55522.	1012726.	0.	18.240	0.	10.805	-87.058	14.533
9) 470.25	55466.	912754.	0.	16.456	0.	10.817	-87.087	14.517
480.00	53415.	858999.	0.	16.081	0.	11.283	-88.249	13.958
490.00	51360.	858864.	0.	16.722	0.	11.774	-89.343	13.366
500.00	49306.	858732.	0.	17.416	0.	12.280	-90.427	12.789
510.00	47252.	858559.	0.	18.169	0.	12.801	-91.571	12.137
520.00	45199.	858380.	0.	18.991	0.	13.337	-92.778	11.388
530.00	43145.	858179.	0.	19.890	0.	13.891	-93.975	10.742
540.00	41092.	857962.	0.	20.879	0.	14.461	-95.211	10.043
550.00	39032.	861875.	0.	22.081	0.	15.050	-96.577	9.220
560.00	36973.	858674.	0.	23.224	0.	15.657	-97.816	8.451
570.00	34919.	858237.	0.	24.577	0.	16.286	-100.235	6.571
580.00	32867.	857623.	0.	26.093	0.	16.935	-100.082	7.100
590.00	30816.	856714.	0.	27.866	0.	17.607	-99.964	7.685
10) 590.64	30685.	856627.	0.	27.916	0.	17.651	-99.964	7.705
600.00	30612.	0.	0.	-0.000	0.	18.293	-99.964	8.269
11) 600.64	30611.	0.	0.	-0.000	0.	18.337	-100.091	8.309

9) EMR Shift
 10) Guidance Cutoff Signal
 11) Orbit Insertion

TABLE 10 E
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
143.00	6432099.	2279.91	65.827	6431111.	63957.	92837.	900.62	330.65	2068.22
144.32	6433324.	2275.06	66.094	6432292.	64394.	95569.	888.04	330.54	2068.34
147.72	6436409.	2267.04	66.781	6435257.	65517.	102604.	857.53	330.44	2072.41
150.72	6439062.	2274.05	67.361	6437798.	66509.	108845.	836.79	330.81	2088.46
154.92	6442690.	2289.24	68.143	6441257.	67899.	117673.	810.32	330.51	2115.36
160.00	6446945.	2308.77	69.068	6445289.	69574.	128492.	778.66	329.73	2148.34
166.48	6452178.	2335.57	70.219	6450204.	71708.	142551.	738.59	328.74	2191.18
166.62	6452292.	2336.20	70.244	6450311.	71755.	142868.	737.70	328.71	2192.16
170.00	6454928.	2351.44	70.827	6452766.	72664.	150305.	717.23	328.11	2215.22
171.75	6456272.	2359.59	71.124	6454012.	73438.	154193.	706.68	327.79	2227.29
180.00	6462401.	2398.71	72.423	6459642.	76132.	172802.	659.77	325.00	2283.17
190.00	6469448.	2447.26	73.742	6465993.	79365.	195956.	610.40	321.61	2347.98
200.00	6476106.	2499.43	75.010	6471849.	82567.	219768.	560.84	318.91	2414.72
210.00	6482380.	2555.05	76.226	6477209.	85745.	244256.	510.98	317.04	2483.28
220.00	6488276.	2614.18	77.384	6482069.	88911.	269440.	461.04	316.20	2553.70
230.00	6493802.	2676.61	78.487	6486429.	92072.	295336.	410.79	316.31	2625.91
240.00	6498964.	2742.48	79.530	6490285.	95240.	321965.	360.41	317.35	2700.11
250.00	6503770.	2811.69	80.522	6493635.	98422.	349345.	309.51	319.27	2776.30
260.00	6508227.	2884.27	81.456	6496475.	101628.	377497.	258.36	322.09	2854.57
270.00	6512343.	2960.67	82.338	6498801.	104867.	406445.	206.71	325.79	2935.42
280.00	6516124.	3040.55	83.171	6504607.	108147.	436213.	154.37	330.39	3018.61
290.00	6519578.	3124.11	83.951	6501887.	111478.	466826.	101.48	335.91	3104.34
300.00	6522712.	3211.33	84.682	6502635.	114868.	498309.	47.87	342.38	3192.66
310.00	6525534.	3302.05	85.364	6502842.	118328.	530688.	-6.48	349.80	3283.47
320.00	6528053.	3396.52	85.996	6502503.	121067.	563988.	-61.54	358.24	3377.02
330.00	6530280.	3494.71	86.584	6501609.	125496.	598237.	-117.52	367.72	3473.32
340.00	6532223.	3597.26	87.124	6500151.	129226.	633466.	-174.34	378.33	3573.06
350.00	6533892.	3703.97	87.627	6498117.	133066.	669709.	-232.63	390.03	3676.03
360.00	6535295.	3814.74	88.087	6495495.	137030.	706997.	-292.04	402.97	3782.14
370.00	6536443.	3929.76	88.504	6492273.	141130.	745363.	-352.57	417.15	3891.62
380.00	6537351.	4049.47	88.880	6488439.	145378.	784842.	-414.38	432.66	4004.91
390.00	6538030.	4174.04	89.221	6483980.	149787.	825475.	-477.92	449.51	4122.15
400.00	6538492.	4303.09	89.522	6478877.	154373.	867297.	-542.92	467.80	4242.99
410.00	6538753.	4437.38	89.786	6473116.	159149.	910350.	-609.54	487.66	4368.19
420.00	6538830.	4577.21	90.015	6466680.	164131.	954676.	-678.13	509.15	4497.97

TABLE 10 E (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)
430.00	6538736.	4722.96	90.209	6459547.	169337.	1000326.	-748.80	532.39	4632.73
440.00	6538492.	4875.50	90.368	6451697.	174785.	1047351.	-821.76	587.55	4773.30
450.00	6538116.	5034.35	90.497	6443103.	180495.	1095809.	-897.31	584.63	4919.12
460.00	6537627.	5200.20	90.591	6433742.	186485.	1145754.	-975.39	613.87	5070.89
470.00	6537050.	5373.69	90.653	6423586.	192780.	1197249.	-1056.35	645.41	5229.16
470.25	6537035.	5378.00	90.655	6423322.	192941.	1198557.	-1058.42	646.20	5233.07
480.00	6536378.	5528.07	90.756	6412599.	199375.	1250228.	-1141.67	673.98	5366.74
490.00	6535599.	5688.34	90.832	6400744.	206266.	1304602.	-1229.87	704.41	5508.94
500.00	6534736.	5855.49	90.876	6387929.	213471.	1360426.	-1320.95	736.93	5656.74
510.00	6533817.	6030.02	90.891	6374314.	221013.	1417757.	-1415.25	771.96	5810.53
520.00	6532870.	6212.59	90.878	6359675.	228919.	1476659.	-1513.28	809.62	5970.82
530.00	6531924.	6403.88	90.837	6344035.	237215.	1537198.	-1615.39	850.08	6138.20
540.00	6531011.	6604.70	90.768	6327352.	245930.	1599450.	-1722.04	893.46	6313.35
550.00	6530165.	6816.84	90.672	6309577.	255095.	1663498.	-1833.93	940.07	6497.87
560.00	6529423.	7040.65	90.553	6290653.	264742.	1729440.	-1951.94	989.88	6691.85
570.00	6528822.	7276.79	90.410	6270519.	274908.	1797369.	-2076.53	1044.03	6895.64
580.00	6528384.	7527.47	90.256	6249085.	285639.	1867390.	-2210.36	1102.72	7110.63
590.00	6528188.	7793.48	90.026	6226305.	296975.	1939632.	-2345.90	1165.00	7340.15
590.64	6528187.	7811.00	90.009	6224807.	297719.	1944316.	-2354.61	1169.10	7355.32
600.00	6528185.	7818.36	90.001	6202360.	308063.	2013122.	-2439.19	1166.98	7335.89
600.64	6528185.	7818.36	90.000	6200803.	309407.	2017798.	-2444.85	1166.71	7334.05

TABLE 11E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	EARTH FIXED			EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS						
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
143.00	89949.	2636.54	62.714	58661.	513.	68238.	918.46	4.11	1817.66	
144.32	92558.	2031.06	63.005	59066.	518.	70639.	906.10	4.17	1817.74	
147.72	99247.	2021.50	63.760	62834.	533.	76822.	876.18	4.49	1821.74	
150.72	105151.	2027.29	64.419	65432.	547.	82311.	856.03	5.27	1837.67	
154.92	113459.	2041.03	65.319	68973.	571.	90085.	830.44	5.58	1864.44	
160.00	123578.	2058.97	66.384	73116.	599.	99630.	799.84	5.57	1897.26	
166.48	136631.	2083.91	67.710	78167.	635.	112061.	761.17	5.62	1939.92	
166.62	136925.	2084.51	67.739	78277.	636.	112342.	760.32	5.62	1940.89	
170.00	143789.	2098.87	68.411	80816.	655.	118931.	740.60	5.60	1963.86	
171.75	147367.	2106.59	68.754	82097.	665.	122378.	730.44	5.58	1975.89	
180.00	164405.	2144.09	70.255	87931.	707.	138913.	685.38	9.26	2031.60	
190.00	185462.	2191.22	71.779	94549.	741.	159550.	638.30	2.69	2096.19	
200.00	206989.	2242.09	73.241	100696.	764.	180843.	591.12	1.97	2162.76	
210.00	229015.	2296.50	74.639	106371.	784.	202811.	543.75	2.24	2231.20	
220.00	251570.	2354.48	75.965	111572.	812.	225473.	496.40	3.70	2301.55	
230.00	274685.	2415.82	77.224	116298.	861.	248848.	448.86	6.29	2373.74	
240.00	298392.	2480.66	78.411	120550.	942.	272555.	401.30	9.97	2447.97	
250.00	322724.	2548.88	79.534	124323.	1004.	297814.	353.34	14.71	2524.23	
260.00	347714.	2620.53	80.589	127016.	1239.	323447.	305.26	20.53	2602.61	
270.00	373399.	2696.02	81.581	130428.	1478.	349876.	256.83	27.43	2683.62	
280.00	399814.	2775.05	82.514	132751.	1771.	377127.	207.83	35.42	2767.03	
290.00	426995.	2857.76	83.385	134583.	2190.	405225.	158.45	44.53	2853.02	
300.00	454981.	2944.15	84.197	135919.	2686.	434196.	108.56	54.80	2941.64	
310.00	483807.	3034.07	84.953	136752.	3290.	464066.	57.97	66.24	3032.79	
320.00	513512.	3127.74	85.652	137077.	4015.	494862.	6.92	78.92	3126.73	
330.00	543133.	3225.13	86.298	136888.	4872.	526610.	-44.89	92.86	3223.48	
340.00	575712.	3326.88	86.890	136178.	5876.	559343.	-97.34	108.18	3323.70	
350.00	608292.	3432.79	87.439	134937.	7040.	593095.	-151.04	124.86	3427.20	
360.00	641916.	3542.75	87.940	133154.	8379.	627898.	-205.66	143.02	3533.89	
370.00	676626.	3656.96	88.393	130821.	9906.	663784.	-261.18	162.69	3643.99	
380.00	712466.	3775.84	88.799	127927.	11638.	700791.	-317.74	183.97	3757.95	
390.00	749488.	3899.57	89.166	124461.	13591.	738957.	-375.77	206.89	3875.90	
400.00	787738.	4027.77	89.489	120409.	15701.	778321.	-435.01	231.56	3997.51	
410.00	827264.	4161.19	89.771	115757.	18228.	818922.	-495.59	258.13	4123.51	
420.00	868122.	4300.14	90.015	110492.	20950.	860807.	-557.84	286.66	4254.15	

TABLE 11 E (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----						
	POSITION (M)	VELOCITY (M/S)	PATH ANGLE (DEG)	X (M)	Y (M)	Z (M)	DX (M/S)	DY (M/S)	DZ (M/S)	
430.00	910368.	4444.99	90+222	104595.	23968.	904022.	+621.85	317+30	4389+83	
440.00	954068.	4596.63	90+391	98048.	27304.	948624.	+687.81	350+25	4531+36	
450.00	999286.	4754.55	90+526	90831.	30981.	994667.	+756.01	385+53	4678+20	
460.00	1046088.	4919.45	90+625	82921.	35023.	1042208.	+826.35	423+40	4831+03	
470.00	1094548.	5091.97	90+689	74296.	39458.	1091310.	+899.17	464+01	4990+42	
470.25	1095781.	5096.25	90+691	74071.	39574.	1092558.	+901.04	468+03	4994+36	
480.00	1144608.	5245.50	90+797	64926.	44285.	1141908.	+976.57	501+70	5129+31	
490.00	1196194.	5404.91	90+876	54757.	49500.	1193914.	+1056.51	541+67	5272+90	
500.00	1249370.	5571.19	90+921	43782.	55127.	1247385.	+1138.93	584+19	5422+15	
510.00	1304207.	5744.83	90+935	31969.	61194.	1302378.	+1224.15	629+70	5577+45	
520.00	1360780.	5926.49	90+920	19288.	67732.	1358957.	+1312.65	678+37	5739+34	
530.00	1419172.	6116.86	90+876	5704.	74773.	1417190.	+1404.74	730+39	5908+40	
540.00	1479472.	6316.74	90+803	+8820.	82351.	1477152.	+1500.84	785+95	6085+31	
550.00	1541780.	6527.94	90+702	+24328.	90505.	1538929.	+1601.60	845+41	6271+69	
560.00	1606211.	6758.80	90+577	+40871.	99273.	1602619.	+1707.88	908+80	6467+65	
570.00	1672878.	6985.97	90+427	+58503.	108698.	1668317.	+1820.06	977+29	6673+53	
580.00	1741907.	7235.65	90+266	+77306.	118838.	1736128.	+1940.73	1051+25	6890+79	
590.00	1813450.	7500.69	90+027	+97321.	129738.	1806183.	+2062.31	1129+56	7122+59	
590.64	1818100.	7518.15	90+009	+98638.	130460.	1810728.	+2070.11	1134+71	7137+90	
600.00	1886526.	7525.39	90+001	+118392.	141126.	1877511.	+2148.79	1141+71	7121+15	
600.64	1891184.	7525.38	90+001	+119764.	141854.	1882050.	+2154.07	1142+05	7119+49	

TABLE 12E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEOGRAPHIC LATITUDE (DEG)
143.00	58.964	67.748	2021.25	45.558	36.423	-80.207	28.955	29.118
144.32	60.195	70.116	2017.99	45.567	36.432	-80.192	28.972	29.135
147.72	63.294	76.212	1997.81	45.578	36.462	-80.155	29.016	29.180
150.72	65.960	81.619	2003.42	45.547	36.503	-80.122	29.055	29.219
154.92	69.605	89.272	2016.92	45.405	36.535	-80.075	29.110	29.274
160.00	73.882	98.659	2034.61	45.356	36.562	-80.018	29.178	29.342
166.48	79.142	110.871	2059.24	45.222	36.599	-79.943	29.266	29.431
166.62	79.258	111.147	2059.84	45.219	36.610	-79.941	29.268	29.433
170.00	81.908	117.614	2074.05	45.148	36.618	-79.901	29.315	29.480
171.75	83.260	120.996	2081.69	45.111	36.627	-79.881	29.339	29.504
180.00	89.427	137.202	2118.90	44.916	36.638	-79.781	29.456	29.621
190.00	96.521	157.403	2165.74	44.707	36.656	-79.656	29.602	29.768
200.00	103.227	178.216	2216.31	44.526	36.701	-79.528	29.752	29.918
210.00	109.550	199.662	2270.42	44.375	36.775	-79.395	29.907	30.073
220.00	115.498	221.763	2328.09	44.258	36.882	-79.257	30.066	30.233
230.00	121.077	244.540	2389.10	44.171	37.016	-79.115	30.229	30.397
240.00	126.294	268.012	2453.60	44.112	37.175	-78.967	30.398	30.566
250.00	131.157	292.204	2521.48	44.077	37.356	-78.814	30.571	30.740
260.00	135.672	317.138	2592.77	44.067	37.558	-78.656	30.749	30.918
270.00	139.849	342.841	2667.91	44.078	37.778	-78.492	30.932	31.102
280.00	143.692	369.340	2746.56	44.110	38.016	-78.321	31.120	31.290
290.00	147.209	396.663	2828.89	44.163	38.271	-78.143	31.313	31.484
300.00	150.409	424.840	2914.90	44.235	38.542	-77.959	31.511	31.683
310.00	153.299	453.898	3004.42	44.326	38.828	-77.767	31.715	31.888
320.00	155.889	483.869	3097.69	44.437	39.129	-77.568	31.925	32.098
330.00	158.188	514.785	3194.66	44.565	39.444	-77.360	32.140	32.314
340.00	160.206	546.679	3295.99	44.712	39.774	-77.144	32.361	32.535
350.00	161.952	579.591	3401.47	44.876	40.117	-76.918	32.588	32.763
360.00	163.434	613.557	3510.98	45.058	40.474	-76.684	32.821	32.997
370.00	164.664	648.616	3624.73	45.257	40.845	-76.439	33.060	33.237
380.00	165.656	684.808	3743.15	45.474	41.230	-76.183	33.306	33.483
390.00	166.422	722.180	3866.40	45.707	41.627	-75.917	33.558	33.736
400.00	166.973	760.773	3994.12	45.959	42.038	-75.638	33.817	33.995
410.00	167.326	800.636	4127.04	46.228	42.464	-75.348	34.082	34.261
420.00	167.497	841.819	4265.47	46.515	42.903	-75.044	34.355	34.534

TABLE 12E (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (KM)	RANGE (KM)	RELATIVE VELOCITY (M/S)	VELOCITY VECTOR SPACE FIXED (DEG)	AZIMUTH EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
430.00	167.501	884.377	4409.79	46.820	43.357	-74.726	34.634	34.815
440.00	167.358	928.373	4560.88	47.143	43.827	-74.393	34.921	35.102
450.00	167.085	973.871	4718.25	47.485	44.312	-74.045	35.216	35.397
460.00	166.703	1020.934	4802.58	47.847	44.813	-73.681	35.518	35.700
470.00	166.236	1069.634	5054.52	48.230	45.331	-73.298	35.827	36.010
470.25	166.223	1070.873	5058.78	48.239	45.344	-73.288	35.835	36.018
480.00	165.676	1119.921	5207.48	48.612	45.831	-72.898	36.144	36.328
490.00	165.012	1171.724	5366.33	49.013	46.347	-72.481	36.468	36.652
500.00	164.267	1225.110	5532.01	49.434	46.881	-72.045	36.799	36.983
510.00	163.470	1280.148	5705.05	49.877	47.435	-71.590	37.136	37.321
520.00	162.647	1336.913	5886.08	50.343	48.010	-71.114	37.480	37.666
530.00	161.828	1395.486	6075.80	50.833	48.606	-70.616	37.831	38.018
540.00	161.045	1455.956	6275.02	51.346	49.224	-70.095	38.190	38.377
550.00	160.332	1518.423	6485.53	51.883	49.865	-69.548	38.555	38.743
560.00	159.725	1582.999	6707.70	52.445	50.528	-68.974	38.928	39.116
570.00	159.263	1649.796	6942.14	53.039	51.222	-68.372	39.308	39.497
580.00	158.968	1718.943	7191.07	53.665	51.946	-67.738	39.696	39.885
590.00	158.918	1790.561	7455.35	54.313	52.690	-67.071	40.091	40.281
590.44	158.925	1795.236	7472.76	54.355	52.738	-67.027	40.117	40.306
600.00	159.061	1863.748	7479.53	54.805	53.217	-66.380	40.489	40.679
600.64	159.070	1868.413	7479.48	54.836	53.249	-66.336	40.514	40.704

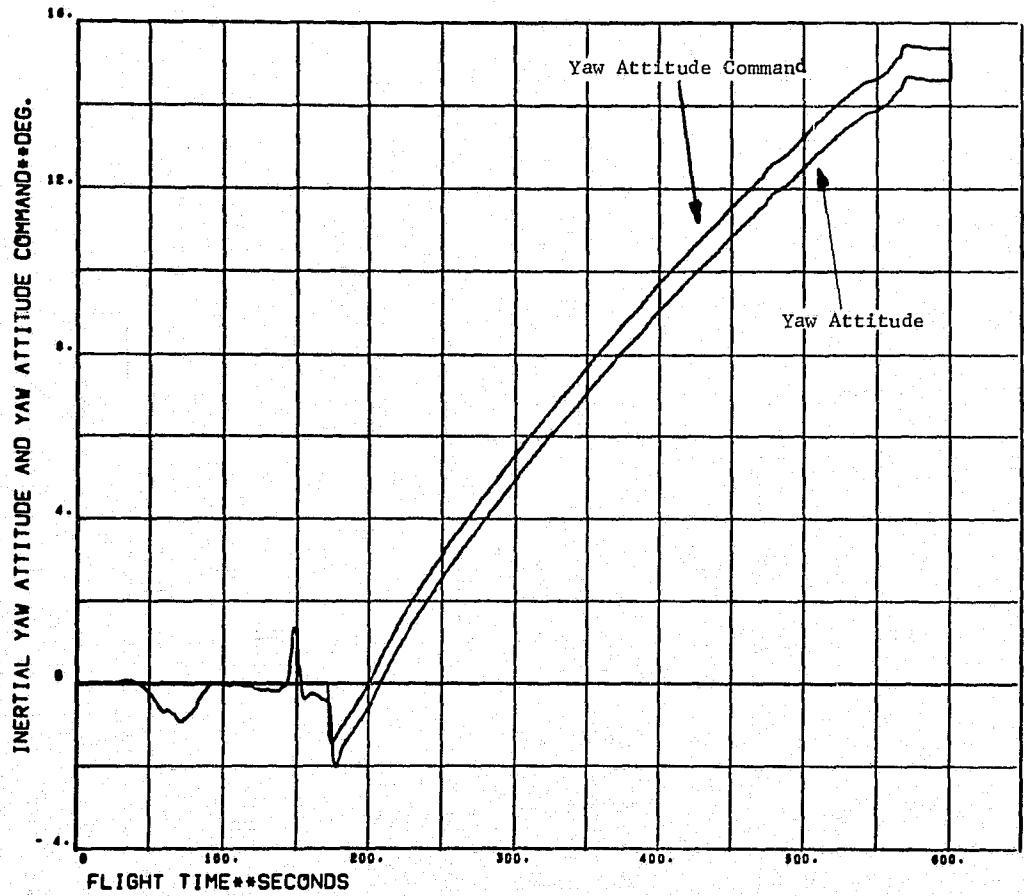
TABLE 13E
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
143.00	-63.756	-0.060	0.005	-0.008	-0.017	0.004	-0.044	-0.060	0.005
144.32	-63.810	0.045	0.018	-0.064	-0.154	0.015	-0.098	-0.045	0.018
147.72	-64.023	1.214	0.113	-0.04	-0.308	0.066	-0.311	1.214	0.111
150.72	-63.727	0.948	0.403	-0.144	-0.352	0.030	-0.012	0.949	0.403
154.92	-63.436	-0.307	0.204	-0.007	-0.110	-0.144	-0.275	-0.307	0.203
160.00	-63.564	-0.262	-0.313	-0.018	-0.022	-0.045	-0.148	-0.261	-0.314
166.48	-63.628	-0.346	-0.356	-0.030	-0.022	0.002	-0.086	-0.345	-0.356
166.62	-63.628	-0.349	-0.356	-0.006	-0.022	-0.001	-0.085	-0.349	-0.356
170.00	-63.653	-0.406	-0.471	-0.010	-0.009	-0.066	-0.061	-0.406	-0.472
171.75	-63.671	-0.416	-0.596	-0.011	-0.003	-0.059	-0.043	-0.416	-0.596
180.00	-56.945	-1.794	-0.011	-0.960	-0.133	-0.443	-1.057	-0.633	0.038
190.00	-56.447	-1.143	-0.604	-0.070	-0.055	-0.002	-0.037	-0.537	-0.605
200.00	-57.434	-0.596	-0.768	-0.131	-0.054	-0.033	-0.112	-0.538	-0.768
210.00	-58.385	0.119	-0.473	-0.089	-0.072	-0.059	-0.063	-0.571	-0.473
220.00	-59.437	0.796	0.064	-0.097	-0.064	-0.055	-0.045	-0.570	0.065
230.00	-60.308	1.417	0.630	-0.093	-0.060	-0.056	-0.060	-0.573	0.032
240.00	-61.377	1.991	0.513	-0.134	-0.054	-0.032	-0.099	-0.571	0.517
250.00	-62.321	2.533	0.274	-0.092	-0.053	-0.023	-0.061	-0.576	0.277
260.00	-63.334	3.046	0.030	-0.108	-0.050	-0.025	-0.080	-0.579	0.035
270.00	-64.616	3.523	-0.254	-0.107	-0.048	-0.024	-0.053	-0.585	-0.251
280.00	-65.597	4.004	-0.476	-0.105	-0.047	-0.023	-0.078	-0.588	-0.470
290.00	-66.729	4.462	-0.715	-0.111	-0.045	-0.023	-0.076	-0.593	-0.709
300.00	-67.833	4.911	-0.643	-0.114	-0.043	-0.055	-0.066	-0.599	-0.637
310.00	-68.783	5.361	-0.059	-0.106	-0.044	-0.057	-0.076	-0.608	-0.052
320.00	-69.894	5.793	0.507	-0.109	-0.043	-0.057	-0.071	-0.614	0.514
330.00	-70.944	6.223	0.547	-0.100	-0.044	-0.042	-0.057	-0.624	0.554
340.00	-72.218	6.622	0.089	-0.145	-0.038	-0.048	-0.113	-0.624	0.103
350.00	-73.383	7.046	-0.347	-0.115	-0.048	-0.043	-0.027	-0.627	-0.344
360.00	-74.393	7.466	-0.737	-0.106	-0.040	-0.037	-0.027	-0.627	-0.734
370.00	-75.473	7.863	-0.215	-0.109	-0.039	-0.052	-0.029	-0.636	-0.211
380.00	-76.626	8.246	0.306	-0.137	-0.035	-0.050	-0.062	-0.640	0.315
390.00	-77.831	8.623	0.809	-0.093	-0.042	-0.037	-0.000	-0.661	0.810
400.00	-78.801	9.032	0.256	-0.114	-0.037	-0.057	-0.034	-0.662	0.262
410.00	-79.975	9.402	-0.313	-0.118	-0.037	-0.057	-0.033	-0.668	-0.307
420.00	-81.147	9.766	-0.540	-0.116	-0.036	-0.024	-0.029	-0.677	-0.536

TABLE 13 % (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
430.00	-82.309	10.128	-0.296	-0.117	-0.036	-0.025	-0.031	-0.685	-0.291
440.00	-83.566	10.466	-0.054	-0.120	-0.035	-0.025	-0.029	-0.695	-0.049
450.00	-84.690	10.834	-0.204	-0.110	-0.036	-0.026	-0.019	-0.704	-0.208
460.00	-85.845	11.180	-0.466	-0.118	-0.034	-0.026	-0.023	-0.712	-0.471
470.00	-87.030	11.516	-0.731	-0.119	-0.034	-0.027	-0.023	-0.722	-0.737
470.25	-87.059	11.524	-0.738	-0.119	-0.034	-0.027	-0.023	-0.722	-0.744
480.00	-88.227	11.931	-0.940	-0.113	-0.021	-0.041	-0.015	-0.709	-0.944
490.00	-89.334	12.156	-0.529	-0.106	-0.030	-0.041	-0.006	-0.735	-0.531
500.00	-90.412	12.503	-0.118	-0.113	-0.037	-0.041	-0.013	-0.749	-0.122
510.00	-91.546	12.875	-0.292	-0.118	-0.029	-0.041	-0.026	-0.745	-0.286
520.00	-92.767	13.194	-0.655	-0.118	-0.032	-0.023	-0.015	-0.757	-0.652
530.00	-93.958	13.490	-0.418	-0.122	-0.027	-0.024	-0.019	-0.758	-0.414
540.00	-95.192	13.745	-0.178	-0.124	-0.024	-0.024	-0.019	-0.763	-0.173
550.00	-96.538	13.896	-0.069	-0.146	-0.016	-0.025	-0.038	-0.766	-0.078
560.00	-97.829	14.168	-0.310	-0.110	-0.046	-0.023	-0.014	-0.808	-0.307
570.00	-100.235	14.693	-0.593	-0.282	-0.024	-0.030	-0.004	-0.765	-0.593
580.00	-100.226	14.671	-0.781	-0.015	-0.004	-0.018	-0.145	-0.760	-0.744
590.00	-100.089	14.614	-0.880	-0.000	-0.000	-0.057	-0.127	-0.772	-0.848
590.64	-100.090	14.613	-0.844	-0.001	-0.000	-0.057	-0.127	-0.773	-0.811
600.00	-100.091	14.613	-0.304	-0.000	-0.000	-0.058	-0.125	-0.773	-0.271
600.64	-100.091	14.614	-0.267	-0.000	-0.000	-0.058	-0.125	-0.773	-0.234

FIGURE 1E
APOLLO/SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
INERTIAL YAW ATTITUDE AND YAW ATTITUDE COMMAND HISTORIES



TIME .V8. CH1Z , THZ

APPENDIX F

**TRAJECTORY LISTING FOR A
TYPICAL LAUNCH WINDOW CLOSING
ENGLISH UNITS**

TABLE 1F

APOLLO SOYUZ TEST PROJECT
 S-IB STAGE END CONDITIONS OF FLIGHT
 TYPICAL LAUNCH WINDOW CLOSING

Flight Time: OECO + 1.379 seconds	143.00	(sec)
Radius:	21102664.	(ft)
Altitude:	193430.	(ft)
Space Fixed Velocity:	7480.05	(ft/s)
Space Fixed Path Angle:	65.826	(deg)
Space Fixed Flight Azimuth:	45.558	(deg)
Earth Fixed Flight Azimuth:	36.423	(deg)
Geocentric Declination:	28.955	(deg)
Geodetic Latitude:	29.118	(deg)
Longitude: (Pos. East)	-80.207	(deg)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	21099423.	(ft)
Ys	=	209830.	(ft)
Zs	=	304538.	(ft)
Xs	=	2954.89	(ft/s)
Ys	=	1084.80	(ft/s)
Zs	=	6785.50	(ft/s)

VEHICLE ATTITUDE AND ATTITUDE RATE

Pitch Attitude Angle:	-63.756	(deg)
Yaw Attitude Angle:	-0.060	(deg)
Roll Attitude Angle:	0.005	(deg)
Pitch Rate:	-0.008	(deg/s)
Yaw Rate:	0.017	(deg/s)
Roll Rate:	0.004	(deg/s)

TABLE 2F

APOLLO SOYUZ TEST PROJECT
S-IVB STAGE END CONDITIONS OF FLIGHT
TYPICAL LAUNCH WINDOW CLOSING

Flight Time: Guidance Cutoff Signal	590.64	(sec)
Radius:	21417936.	(ft)
Altitude:	521409.	(ft)
Space Fixed Velocity:	25626.63	(ft/s)
Space Fixed Flight Path Angle:	90.009	(deg)
Space Fixed Flight Azimuth:	54.355	(deg)
Earth Fixed Flight Azimuth:	52.738	(deg)
Geocentric Declination:	40.117	(deg)
Geodetic Latitude:	40.306	(deg)
Longitude: (Pos. East)	-67.027	(deg)
Inclination:	51.577	(deg)
Descending Node Argument:	154.192	(deg)
Inertial Range Angle:	17.650	(deg)
Weight:	67650.	(lbs)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs =	20422595.	(ft)
Ys =	976767.	(ft)
Zs =	6378990.	(ft)
\dot{X}_s =	- 7725.10	(ft/s)
\dot{Y}_s =	3835.63	(ft/s)
\dot{Z}_s =	24131.62	(ft/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-100.090	(deg)
Yaw Attitude Angle	=	14.613	(deg)
Roll Attitude Angle	=	0.844	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	458366.16	(ft)
*Apogee Altitude	=	493011.83	(ft)
Eccentricity	=	.00080	(ft)
Semi-Major Axis	=	21401410.79	(ft)
True Anomaly	=	191.68	(deg)
Period	=	87.39	(min)

*Referenced to Equatorial Radius (20925721.78 ft)

TABLE 2F (CONTINUED)

APOLLO SOYUZ TEST PROJECT
 S-IVB STAGE END CONDITIONS OF FLIGHT
 TYPICAL LAUNCH WINDOW CLOSING

Flight Time: Orbit Insertion	600.64	(sec)
Radius:	21417930.	(ft)
Altitude:	521884.	(ft)
Space Fixed Velocity:	25650.78	(ft/s)
Space Fixed Flight Path Angle:	90.000	(deg)
Space Fixed Flight Azimuth:	54.836	(deg)
Earth Fixed Flight Azimuth:	53.249	(deg)
Geocentric Declination:	40.514	(deg)
Geodetic Latitude:	40.704	(deg)
Longitude: (Pos. East)	-66.335	(deg)
Inclination:	51.574	(deg)
Descending Node Argument:	154.186	(deg)
Inertial Range Angle:	18.337	(deg)
Weight:	67486.	(lbs)

SPACE FIXED POSITION AND VELOCITY COMPONENTS

Xs	=	20343843.	(ft)
Ys	=	1015114.	(ft)
Zs	=	6620071.	(ft)
Xs	=	- 8021.17	(ft/s)
Ys	=	3827.78	(ft/s)
Zs	=	24061.83	(ft/s)

VEHICLE ATTITUDE ANGLES

Pitch Attitude Angle	=	-100.091	(deg)
Yaw Attitude Angle	=	14.614	(deg)
Roll Attitude Angle	=	0.267	(deg)

OSCULATING CONIC PARAMETERS

*Perigee Altitude	=	491830.72	(ft)
*Apogee Altitude	=	542880.59	(ft)
Eccentricity	=	.00118	
Semi-Major Axis	=	21443110.27	(ft)
True Anomaly	=	359.59	(deg)
Period	=	87.64	(min)

*Referenced to Equatorial Radius (20925721.78 ft)

TABLE 3F
 APOLLO SOYUZ TEST PROJECT
 SEQUENCE OF EVENTS
 TYPICAL LAUNCH WINDOW CLOSING

FLIGHT TIME (SEC)	PROGRAM TIME (SEC)	
-17.20	---	Guidance Reference Release (GRR)
0.00	---	First Motion
0.20	(0.00) ₁	Lift-off Signal; Initiate Time Base One
59.63	---	Mach One
74.35	---	Maximum Dynamic Pressure
132.00	(131.80)	Tilt Arrest
135.62	(0.00) ₂	Level Sensor Activation; Initiate Time Base Two
138.62	(3.00) ₂	Inboard Engine Cutoff (IECO)
141.62	(0.00) ₃	Outboard Engine Cutoff (OECO); Initiate Time Base Three
142.72	(1.10) ₃	Ignite Ullage Rockets
142.92	(1.30) ₃	Separation Signal
143.00	---	S-IB/S-IVB Physical Separation
144.32	(2.70) ₃	S-IVB J-2 Engine Start Command
147.72	---	90 Percent J-2 Thrust Level
150.72	---	Termination of Ullage Burn
154.92	(13.30) ₃	Jettison Ullage Rockets
166.48	---	Dynamic Pressure = 1 PSF
166.62	---	LES Jettison
171.75	(30.00) ₃	IGM Initiation
469.72	(328.10) ₃	EMR Shift Command
590.64	---	Guidance Cutoff Signal (GCS)
590.84	(0.00) ₄	Inertial Attitude Freeze; Initiate Time Base Four
600.64	----	Orbit Insertion (OI)

TABLE 4F

 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-IB STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/SEC2)	DYNAMIC PRESSURE (LB/FT2)	A+H+I (LB-FT/FT2+RAD)	MACH NO.	PITCH ANGLE OF ATTACK (DEG)
1) -17.20	1311032.	0.	0.	0.000	0.	0.	0.00	N/A
2) 0.00	1296854.	1603375.	59.	39.847	0.	0.	0.00	N/A
10.00	1234179.	1651115.	2568.	43.044	11.	1601.	0.9	-1.764
20.00	1171128.	1676514.	9892.	45.052	52.	33007.	2.0	-1.317
30.00	1107765.	1699800.	21325.	48.012	137.	211965.	3.3	-0.668
40.00	1044310.	1726629.	34987.	52.0185	270.	826040.	5.1	-0.091
50.00	980797.	1758276.	54411.	55.056	436.	2376738.	7.3	0.163
3) 59.63	919619.	1785944.	148615.	57.0342	591.	5498964.	1.00	0.296
60.00	917296.	1786844.	152491.	57.0382	595.	5646415.	1.01	0.298
70.00	853472.	1816958.	149332.	62.054	684.	10671203.	1.37	0.192
4) 74.35	825708.	1828556.	129426.	66.049	697.	13470290.	1.57	0.066
80.00	789610.	1840527.	108469.	70.051	673.	17563221.	1.86	0.140
90.00	725982.	1853499.	70698.	79.011	507.	25225423.	2.40	-0.251
100.00	662622.	1857286.	38985.	88.0289	319.	31914667.	2.95	-0.503
110.00	599406.	1854530.	19693.	98.0495	179.	36932419.	3.56	-1.280
120.00	536416.	1846825.	5439.	110.0458	92.	40291031.	4.23	-2.077
130.00	473755.	1834856.	-1120.	124.701	45.	42373057.	5.02	-3.055
5) 132.00	461292.	1831562.	-1765.	127.085	39.	42679887.	5.21	-3.261
6) 135.62	438723.	1824657.	-3172.	134.053	31.	43165304.	5.64	-2.545
7) 138.62	420125.	1816162.	-4905.	139.064	25.	43516191.	6.05	-1.634
140.00	414938.	928067.	-4863.	72.041	22.	43650983.	6.18	-1.290
8) 141.62	408807.	803133.	-5039.	63.006	19.	43831080.	6.32	-0.805
9) 142.72	407413.	55544.	-4662.	4.055	17.	43932902.	6.37	-0.515
10) 142.92	407159.	57479.	-4571.	4.0903	16.	43946829.	6.37	-0.407
11) 143.00	407130.	54594.	-4537.	4.0673	16.	43951966.	6.38	-0.449

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- 1) Guidance Reference Release
- 2) First Motion
- 3) Mach One
- 4) Maximum Dynamic Pressure
- 5) Tilt Arrest
- 6) LSA, Initiate Time Base Two
- 7) IEKO
- 8) OECO, Initiate Time Base Three
- 9) Ignite Ullage Rockets
- 10) Separation Signal
- 11) S-IB/S-IVB Physical Separation

TABLE 5F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---						
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)	
135	17.20	20910035.	1340.44	90.000	20909952.	34769.	-47603.	0.00	1082.46	790.61
	0.00	20910034.	1340.44	90.000	20909939.	53383.	-33999.	-1.48	1081.98	791.26
	10.00	20910497.	1343.56	85.853	20910383.	64200.	-26084.	94.84	1081.37	791.71
	20.00	20912059.	1364.48	80.725	20911917.	75071.	-18132.	216.74	1080.97	803.94
	30.00	20914984.	1423.16	74.958	20914806.	85820.	-9891.	365.31	1081.02	850.48
	40.00	20919535.	1531.57	69.138	20919312.	96643.	-990.	540.45	1084.41	936.85
	50.00	20925979.	1700.61	63.933	20925701.	107519.	9013.	741.22	1070.97	1073.53
	59.63	20934189.	1922.46	60.170	20933847.	118058.	20222.	948.91	1076.32	1262.34
	60.00	20934541.	1931.67	60.065	20934195.	118459.	20685.	956.49	1096.50	1270.49
	70.00	20945242.	2221.77	57.897	20944813.	129463.	34624.	1171.42	1104.74	1530.87
	74.35	20950599.	2376.48	57.280	20950128.	134272.	41581.	1274.17	1107.53	1672.58
	80.00	20958261.	2645.92	56.786	20957727.	140542.	51622.	1415.37	1110.46	1885.32
	90.00	20973854.	3093.88	56.846	20973180.	151637.	72709.	1675.91	1107.27	2353.17
	100.00	20992118.	3698.37	57.944	20991253.	162688.	99122.	1940.51	1103.55	2948.65
	110.00	21013154.	4422.60	59.495	21012021.	173713.	132097.	2212.90	1101.50	3667.31
	120.00	21037033.	5277.21	61.338	21035511.	184715.	172938.	2484.55	1078.70	4524.25
	130.00	21063779.	6280.05	63.345	21061689.	195679.	223123.	2748.73	1093.29	5539.69
	132.00	21069471.	6500.39	63.759	21067238.	197864.	234427.	2800.07	1091.86	5763.90
	135.62	21080079.	6918.10	64.492	21077557.	201817.	256087.	2893.88	1089.09	6180.65
	138.62	21089160.	7282.58	65.021	21086367.	205080.	275203.	2979.61	1086.70	6555.68
	140.00	21093403.	7383.06	65.267	21090476.	206574.	284302.	2989.01	1085.89	6663.06
	141.62	21090427.	7474.83	65.557	21095333.	208338.	295214.	2988.07	1085.21	6765.12
	142.72	21101820.	7482.27	65.771	21098609.	209532.	302672.	2962.99	1084.88	6784.40
	142.92	21102434.	7480.67	65.811	21099201.	209749.	304029.	2957.11	1084.82	6785.21
	143.00	21102664.	7480.05	65.826	21099423.	209830.	304538.	2954.89	1084.80	6785.50

TABLE 6F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
-17.20	295.	.00	N/A	295.	-0.	-0.	-0.00	-0.00	-0.00
0.00	295.	.00	N/A	295.	-0.	0.	-0.00	-0.00	.00
10.00	758.	97.17	0400	758.	-20.	0.	97.17	-0.49	-0.05
20.00	2320.	220.25	30153	2320.	-10.	31.	219.95	-0.96	11.54
30.00	5257.	373.88	80940	5245.	-22.	344.	369.47	-1.17	57.24
40.00	9886.	564.04	140765	9799.	-22.	1308.	545.73	1.77	142.54
50.00	16591.	797.84	20508	16247.	25.	3361.	747.85	7.73	277.86
59.63	25418.	1064.27	26032	24464.	124.	6897.	957.18	12.45	465.10
60.00	25803.	1074.69	26242	24816.	129.	7068.	964.83	12.61	473.19
70.00	37841.	1370.23	310862	35528.	291.	13025.	1181.93	20.27	731.68
74.35	44097.	1554.04	340249	40890.	384.	16506.	1285.82	22.83	872.46
80.00	53321.	1793.50	370261	48559.	522.	22020.	1420.71	25.53	1083.88
90.00	73132.	2294.84	420497	64164.	767.	35080.	1692.91	22.20	1549.15
100.00	98242.	2904.82	470488	82436.	969.	53439.	1962.28	18.94	2141.75
110.00	129759.	3631.07	510811	103444.	1153.	78329.	2240.74	18.08	2657.17
120.00	168898.	4485.43	550645	127250.	1332.	111051.	2520.01	17.47	3710.57
130.00	217023.	5486.71	590104	153028.	1499.	153080.	2793.66	15.62	4722.20
132.00	227859.	5706.63	590758	159469.	1530.	162749.	2847.15	15.10	4945.62
135.62	248620.	6123.64	600889	169966.	1583.	181440.	2945.10	14.15	5368.91
138.62	266949.	6488.02	610706	178935.	1624.	198095.	3034.47	13.37	5734.65
140.00	275678.	6587.70	620037	183120.	1642.	206064.	3045.22	13.23	5841.60
141.62	286137.	6678.24	620410	188670.	1664.	215641.	3045.75	13.33	5943.24
142.72	293277.	6684.22	620653	191410.	1679.	222195.	3021.30	13.45	5962.37
142.92	294575.	6682.32	620697	192014.	1681.	223388.	3015.61	13.47	5963.17
143.60	295061.	6681.59	620713	192240.	1682.	223835.	3013.43	13.48	5963.44

TABLE 7F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
-17.20	0.	0000	.00	90.000	N/A	-80.621	28.466	28.627
0.00	295.	0000	3.91	90.000	N/A	-80.621	28.466	28.627
10.00	758.	0001	97.28	89.978	39.320	-80.621	28.466	28.627
20.00	2321.	0006	220.22	89.553	29.844	-80.621	28.466	28.627
30.00	5246.	059	372.89	88.001	34.383	-80.620	28.467	28.628
40.00	9799.	219	560.27	85.368	36.489	-80.619	28.469	28.630
50.00	16248.	559	787.92	81.651	37.478	-80.615	28.473	28.635
57.63	24466.	1143	1044.87	77.159	37.482	-80.608	28.481	28.643
60.00	24818.	1171	1054.82	76.981	37.478	-80.608	28.481	28.643
70.00	35532.	2154	1355.85	72.001	37.584	-80.596	28.494	28.656
74.35	40897.	2727	1512.99	69.697	37.514	-80.590	28.502	28.664
80.00	48572.	3634	1753.19	66.687	37.384	-80.579	28.514	28.676
90.00	64194.	5781	2280.77	61.400	36.870	-80.555	28.542	28.704
100.00	82499.	8792	2886.62	56.745	36.610	-80.520	28.583	28.745
110.00	103592.	12867	3581.34	52.982	36.500	-80.474	28.637	28.799
120.00	127544.	18214	4415.88	49.963	36.446	-80.414	28.709	28.871
130.00	154386.	25068	5421.90	47.539	36.412	-80.337	28.801	28.963
132.00	160100.	26642	5645.06	47.116	36.407	-80.319	28.822	28.984
135.62	170750.	29684	6065.50	46.396	36.402	-80.285	28.862	29.025
138.62	179868.	32392	6427.88	45.850	36.402	-80.254	28.899	29.062
140.00	184130.	33687	6522.80	45.705	36.406	-80.240	28.916	29.079
141.62	189175.	35243	6623.46	45.576	36.414	-80.222	28.937	29.100
142.72	192583.	36308	6633.50	45.558	36.421	-80.210	28.951	29.114
142.92	193199.	36501	6631.97	45.558	36.422	-80.208	28.954	29.117
143.00	193430.	36574	6631.43	45.558	36.423	-80.207	28.955	29.118

TABLE 8F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-1B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
-17.20	-0.000	-0.000	-53.856	-0.002	-0.003	-0.002	-0.000	-0.000	-0.000
-0.00	-0.037	-0.051	-53.822	-0.002	-0.003	-0.002	-0.037	-0.051	-0.034
10.00	-0.024	-0.004	-53.856	-0.000	-0.001	-0.000	-0.011	-0.022	-0.000
20.00	-3.512	-0.004	-45.289	-0.408	-0.000	1.004	-0.227	-0.232	-0.933
30.00	-7.728	-0.032	-35.285	-0.439	-0.007	1.000	-0.288	-0.242	-0.929
40.00	-12.377	-0.038	-25.285	-0.497	-0.009	1.000	-0.400	-0.225	-0.928
50.00	-17.812	-0.202	-15.288	-0.555	-0.032	0.999	-0.450	-0.089	-0.933
59.63	-23.265	-0.673	-5.662	-0.557	-0.011	1.000	-0.342	-0.645	-0.941
60.00	-23.470	-0.679	-5.296	-0.561	-0.018	1.000	-0.344	-0.650	-0.941
70.00	-29.229	-0.870	-0.006	-0.598	-0.051	-0.003	-0.369	-0.870	-0.009
74.35	-31.840	-0.883	-0.001	-0.595	-0.030	-0.001	-0.456	-0.883	-0.003
80.00	-35.444	-0.690	-0.002	-0.671	-0.037	-0.001	-0.550	-0.690	-0.005
90.00	-42.558	-0.104	-0.002	-0.762	-0.048	-0.003	-0.648	-0.104	-0.001
100.00	-47.927	-0.006	-0.009	-0.501	-0.004	-0.001	-0.440	-0.006	-0.009
110.00	-52.813	-0.027	-0.017	-0.494	-0.003	-0.000	-0.444	-0.027	-0.017
120.00	-57.563	-0.058	-0.014	-0.468	-0.002	-0.000	-0.447	-0.058	-0.013
130.00	-62.348	-0.159	-0.010	-0.469	-0.003	-0.000	-0.406	-0.160	-0.009
132.00	-63.287	-0.165	-0.009	-0.470	-0.003	-0.000	-0.425	-0.166	-0.008
135.62	-63.819	-0.170	-0.007	-0.558	-0.001	-0.003	-0.107	-0.170	-0.007
138.62	-63.792	-0.169	-0.005	-0.012	-0.002	-0.000	-0.080	-0.169	-0.005
140.00	-63.789	-0.124	-0.004	-0.016	-0.055	-0.001	-0.076	-0.124	-0.004
141.62	-63.761	-0.073	-0.003	-0.015	-0.069	-0.001	-0.049	-0.073	-0.003
142.72	-63.754	-0.064	-0.004	-0.004	-0.014	-0.003	-0.042	-0.064	-0.004
142.92	-63.755	-0.061	-0.004	-0.007	-0.016	-0.004	-0.043	-0.061	-0.004
143.00	-63.756	-0.060	-0.005	-0.008	-0.017	-0.004	-0.043	-0.060	-0.005

TABLE 9F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL)	DRAG (LB)	S-4B STAGE FLIGHT DATA			CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
				LONGITUDINAL ACCELERATION (FT/SEC ²)	DYNAMIC PRESSURE (LB/FT ²)	CENTER			
1)	143.00	306011.	9009.	753.	.868	16.	1.069	-63.712	-0.448
2)	144.32	306011.	8984.	649.	.877	14.	1.092	-63.712	-0.160
3)	147.72	305346.	180766.	466.	19.000	9.	1.152	-63.712	.282
4)	150.72	303902.	194877.	331.	20.599	6.	1.206	-63.712	1.316
5)	154.92	301658.	229119.	203.	24.417	4.	1.282	-63.712	2.582
	160.00	298800.	229156.	118.	24.664	2.	1.376	-63.712	3.615
6)	166.48	288361.	229246.	59.	25.573	1.	1.498	-63.712	5.019
7)	166.62	288014.	229241.	58.	25.603	1.	1.501	-63.712	5.051
	170.00	284156.	229605.	41.	25.994	1.	1.565	-63.712	5.771
8)	171.75	283208.	230695.	34.	26.205	1.	1.599	-63.712	6.132
	180.00	278736.	23031.	25.	26.551	0.	1.761	-55.888	14.552
	190.00	273316.	230062.	8.	27.082	0.	1.963	-56.481	16.792
	200.00	267901.	230078.	3.	27.631	0.	2.170	-57.543	17.490
	210.00	262494.	229580.	1.	28.139	0.	2.384	-58.445	18.181
	220.00	257089.	229406.	1.	28.709	0.	2.604	-59.483	18.723
	230.00	251697.	228951.	0.	29.266	0.	2.830	-60.371	19.395
	240.00	246304.	228852.	0.	29.894	0.	3.062	-61.479	19.772
	250.00	240921.	228527.	0.	30.519	0.	3.301	-62.383	20.208
	260.00	235538.	228521.	0.	31.215	0.	3.547	-63.415	20.507
	270.00	230141.	228832.	0.	31.991	0.	3.800	-64.668	20.474
	280.00	224747.	228984.	0.	32.780	0.	4.060	-65.673	20.691
	290.00	219347.	228794.	0.	33.559	0.	4.328	-66.802	20.698
	300.00	213950.	228554.	0.	34.370	0.	4.604	-67.896	20.708
	310.00	208563.	228688.	0.	35.278	0.	4.888	-68.859	20.872
	320.00	203175.	228522.	0.	36.187	0.	5.180	-69.967	20.825
	330.00	197790.	228707.	0.	37.203	0.	5.480	-71.005	20.745
	340.00	192388.	229070.	0.	38.308	0.	5.790	-72.332	20.343
	350.00	186990.	228736.	0.	39.357	0.	6.109	-73.408	20.015
	360.00	181598.	228554.	0.	40.493	0.	6.438	-74.416	19.804
	370.00	176208.	228307.	0.	41.686	0.	6.776	-75.501	19.584
	380.00	170808.	229072.	0.	43.148	0.	7.125	-76.690	19.256
	390.00	165411.	227948.	0.	44.338	0.	7.485	-77.835	18.844
	400.00	160026.	227916.	0.	45.823	0.	7.856	-78.837	18.516
	410.00	154641.	227853.	0.	47.405	0.	8.238	-80.007	17.944
	420.00	149258.	227799.	0.	49.104	0.	8.633	-81.174	17.387

1) S-IB/S-IVB Physical Separation 5) Jettison Ullage Rockets
 2) S-IVB Start Command 6) Dynamic Pressure = 1 PSF
 3) J-2 90 Percent Thrust 7) LES Jettison
 4) Termination of Ullage Burn 8) IGM Initiation

TABLE 9 F (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	MASS (LB)	THRUST (TOTAL) (LB)	DRAG (LB)	LONGITUDINAL ACCELERATION (FT/S ²)	DYNAMIC PRESSURE (LB/FT ²)	CENTRAL RANGE ANGLE (DEG)	PITCH ATT. COMMAND (DEG)	PITCH ANGLE OF ATTACK (DEG)
430.00	143871.	220525.	0.	51.104	0.	9.040	-82.339	16.874
440.00	138469.	228730.	0.	53.146	0.	9.460	-83.595	16.240
450.00	133079.	227862.	0.	55.089	0.	9.894	-84.710	15.723
460.00	127693.	227808.	0.	57.399	0.	10.342	-85.871	15.152
470.00	122405.	227670.	0.	59.842	0.	10.805	-87.058	14.533
9)	470.25	122281.	205195.	0.	53.984	0.	10.817	-87.087
	480.00	117759.	193111.	0.	52.761	0.	11.283	-88.249
	490.00	113230.	193080.	0.	54.862	0.	11.774	-89.343
	500.00	108701.	193051.	0.	57.139	0.	12.280	-90.427
	510.00	104173.	193012.	0.	59.611	0.	12.801	-91.571
	520.00	99646.	192971.	0.	62.300	0.	13.337	-92.778
	530.00	95119.	192926.	0.	65.256	0.	13.891	-93.975
	540.00	90593.	192877.	0.	68.499	0.	14.461	-95.211
	550.00	86052.	193757.	0.	72.443	0.	15.050	-96.577
	560.00	81512.	193438.	0.	76.193	0.	15.657	-97.816
	570.00	76984.	192939.	0.	80.633	0.	16.286	-100.235
	580.00	72459.	192801.	0.	85.608	0.	16.935	-100.082
	590.00	67938.	192597.	0.	91.208	0.	17.607	-99.964
10)	590.64	67650.	192577.	0.	91.587	0.	17.651	-99.964
	600.00	67489.	0.	0.	-0.000	0.	18.293	-99.964
11)	600.64	67486.	0.	1.	-0.000	0.	18.337	-100.091

9) EMR Shift
 10) Guidance Cutoff Signal
 11) Orbit Insertion

TABLE 10 F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- SPACE FIXED -----			--- SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS ---					
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
143.00	21102685.	7480.02	65.827	21099444.	209834.	304584.	2954.78	1084.80	6785.51
144.32	21106706.	7464.09	66.094	21103320.	211267.	313548.	2913.50	1084.46	6785.88
147.72	21116826.	7437.78	66.781	21113049.	214952.	336628.	2813.43	1084.12	6799.25
150.72	21125531.	7460.81	67.361	21121386.	218207.	357103.	2745.37	1085.32	6851.91
154.92	21137433.	7510.63	68.143	21132733.	222765.	386066.	2658.55	1084.35	6940.16
160.00	21151395.	7574.70	69.068	21145962.	228261.	421561.	2554.65	1081.78	7048.37
166.48	21168562.	7662.62	70.219	21162087.	235261.	467686.	2423.18	1078.54	7188.92
166.62	21168938.	7664.70	70.244	21162438.	235417.	468728.	2420.28	1078.46	7192.14
170.00	21177585.	7714.70	70.827	21170493.	239054.	493128.	2353.12	1076.48	7267.77
171.75	21181993.	7741.43	71.124	21174581.	240937.	505881.	2318.52	1075.42	7307.38
180.00	21202104.	7869.77	72.423	21193051.	249778.	566934.	2164.60	1066.27	7490.72
190.00	21225224.	8029.05	73.742	21213880.	260383.	642900.	2002.64	1055.16	7703.36
200.00	21247067.	8260.22	75.810	21233102.	270888.	721023.	1840.02	1046.30	7922.32
210.00	21267650.	8382.71	76.226	21250685.	281317.	801366.	1676.45	1040.17	8147.23
220.00	21284994.	8576.71	77.384	21260632.	291702.	883988.	1512.60	1037.41	8378.29
230.00	21305123.	8781.52	78.487	21280934.	302075.	968951.	1347.75	1037.77	8615.20
240.00	21322060.	8997.65	79.530	21293586.	312467.	1056314.	1182.45	1041.18	8858.63
250.00	21337828.	9224.70	80.522	21304577.	322908.	1146145.	1015.47	1047.48	9108.60
260.00	21352451.	9462.84	81.456	21313894.	333426.	1238509.	847.63	1056.72	9365.37
270.00	21365955.	9713.47	82.338	21321527.	344051.	1333482.	678.19	1068.88	9630.63
280.00	21378360.	9975.57	83.171	21327452.	354813.	1431147.	506.45	1083.95	9903.56
290.00	21389690.	10249.70	83.951	21331651.	365746.	1531582.	332.93	1102.07	10184.84
300.00	21399972.	10535.85	84.682	21334104.	376864.	1634872.	157.04	1123.28	10474.62
310.00	21409231.	10833.51	85.364	21334784.	388216.	1741101.	-21.27	1147.64	10772.53
320.00	21417498.	11143.45	85.996	21333672.	399828.	1850353.	-201.89	1175.34	11079.45
330.00	21424802.	11465.58	86.584	21330737.	411733.	1962720.	-385.56	1206.43	11395.41
340.00	21431178.	11802.03	87.124	21325954.	423969.	2078301.	-572.00	1241.24	11722.63
350.00	21436653.	12152.14	87.627	21319282.	436570.	2197208.	-763.21	1279.64	12060.45
360.00	21441255.	12515.55	88.087	21310678.	449575.	2319545.	-958.12	1322.09	12408.59
370.00	214445024.	12892.92	88.504	21300148.	463025.	2445417.	-1156.74	1368.60	12767.78
380.00	21448002.	13285.66	88.880	21287531.	476961.	2574942.	-1359.52	1419.49	13139.47
390.00	21450230.	13694.35	89.221	21272899.	491429.	2708251.	-1567.98	1474.76	13624.11
400.00	21451745.	14117.75	89.522	21256157.	506472.	2845463.	-1781.22	1534.77	13920.58
410.00	21452603.	14558.33	89.786	21237258.	522141.	2986711.	-1999.80	1599.94	14331.29
420.00	21452853.	15617.08	90.015	21210140.	538488.	3132141.	-2224.84	1670.44	14757.11

TABLE 10F (Continued)

 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	SPACE FIXED			SPACE FIXED POSITION AND VELOCITY VECTOR COMPONENTS						
	RADIUS (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)	
430.00	21452547.	15495.27	90.209	21192739.	555669.	3281908.	-2450.68	1746.68	15199.25	
440.00	21451746.	15995.75	90.368	21166983.	573443.	3436192.	-2696.06	1829.23	15660.43	
450.00	21450510.	16516.91	90.497	21138790.	592174.	3595174.	-2943.94	1918.07	16138.85	
460.00	21448908.	17061.03	90.591	21108078.	611828.	3759036.	-3200.09	2014.02	16636.76	
470.00	21447016.	17630.21	90.653	21074758.	632479.	3927983.	-3465.73	2117.48	17156.03	
470.25	21446966.	17644.34	90.655	21073891.	633009.	3932273.	-3472.52	2120.08	17168.86	
480.00	21444811.	18136.70	90.756	21038710.	654118.	4101796.	-3745.62	2211.22	17607.41	
490.00	21442253.	18662.54	90.832	20999815.	676725.	4280189.	-4035.01	2311.06	18073.96	
500.00	21439421.	19210.91	90.876	20957979.	700363.	4463339.	-4333.82	2417.76	18558.87	
510.00	21436406.	19783.53	90.891	20914144.	725108.	4651434.	-4643.22	2532.66	19063.42	
520.00	21433300.	20382.50	90.878	20865075.	751045.	4844681.	-4964.84	2656.23	19589.31	
530.00	21430196.	21010.10	90.837	20813763.	778264.	5043301.	-5299.85	2788.97	20138.46	
540.00	21427201.	21668.97	90.768	20759028.	806857.	5247538.	-5649.74	2931.31	20713.09	
550.00	21424427.	22364.96	90.672	20700711.	836927.	5457676.	-6016.81	3084.22	21318.47	
560.00	21421990.	23099.25	90.553	20638624.	868577.	5674015.	-6404.06	3247.65	21954.88	
570.00	21420019.	23874.00	90.410	20572567.	901928.	5896881.	-6812.75	3425.28	22623.48	
580.00	21418583.	24696.42	90.256	20502488.	937136.	6126608.	-7251.82	3617.86	23326.85	
590.00	21417941.	25569.15	90.026	20427511.	974326.	6363622.	-7696.51	3822.17	24081.86	
590.64	21417936.	25626.63	90.009	20422595.	976767.	6378996.	-7725.10	3835.63	24131.62	
600.00	21417931.	25653.80	90.001	20348950.	1012673.	6604731.	-8002.60	3828.69	24067.89	
600.64	21417930.	25650.78	90.000	20343843.	1015114.	6626071.	-8021.17	3827.78	24061.83	

TABLE 117
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	EARTH FIXED			EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
143.00	295108.	6681.55	62.714	192261.	1683.	223878.	3013.32	13.48	5963.46
144.32	303667.	6663.60	63.005	196215.	1700.	231756.	2972.76	13.67	5963.73
147.72	325614.	6632.21	63.760	206148.	1747.	252040.	2874.60	14.74	5976.84
150.72	344983.	6651.22	64.419	214672.	1796.	270048.	2808.51	17.29	6029.15
154.92	372240.	6696.28	65.319	226291.	1872.	295553.	2724.55	18.31	6116.92
160.00	405440.	6755.17	66.384	239863.	1965.	326870.	2624.16	16.26	6224.60
166.48	448266.	6836.99	67.710	256454.	2084.	367654.	2497.28	18.45	6364.56
166.62	449230.	6838.95	67.739	256816.	2087.	368577.	2494.49	18.45	6367.76
170.00	471750.	6886.07	68.411	265125.	2149.	390194.	2429.78	18.36	6443.12
171.75	483486.	6911.38	68.754	269348.	2181.	401504.	2396.45	18.29	6482.58
180.00	539386.	7034.43	70.255	288486.	2321.	455750.	2248.62	13.96	6665.34
190.00	608473.	7189.04	71.779	310201.	2432.	523458.	2094.17	8.82	6877.26
200.00	679099.	7355.93	73.241	330368.	2506.	593317.	1939.39	6.46	7095.67
210.00	751361.	7534.45	74.637	348986.	2571.	665392.	1783.97	7.35	7320.20
220.00	825360.	7724.68	75.965	366050.	2665.	739742.	1628.62	12.15	7551.03
230.00	901196.	7925.91	77.224	381557.	2826.	816432.	1472.64	20.62	7787.87
240.00	978975.	8138.65	78.411	395504.	3089.	895522.	1316.59	32.70	8031.38
250.00	1058806.	8362.47	79.534	407884.	3491.	977082.	1159.27	48.27	8281.59
260.00	1140795.	8597.54	80.589	418689.	4066.	1061177.	1001.50	67.36	8538.74
270.00	1225062.	8845.22	81.581	427913.	4849.	1147887.	842.60	90.00	8804.54
280.00	13111725.	9104.48	82.514	435536.	5877.	1237294.	681.86	116.20	9078.17
290.00	1400903.	9375.85	83.385	441547.	7185.	1329479.	519.84	146.11	9360.29
300.00	1492719.	9659.29	84.197	445928.	8811.	1424529.	355.96	179.80	9651.06
310.00	1587294.	9954.30	84.953	448664.	10793.	1522527.	190.19	217.33	9950.11
320.00	1684749.	10261.61	85.652	449727.	13171.	1623562.	22.69	258.94	10258.32
330.00	1785212.	10581.13	86.298	449107.	15986.	1727724.	-147.27	304.67	10575.72
340.00	1888818.	10914.96	86.890	446777.	19280.	1835116.	-319.35	354.94	10904.51
350.00	1995709.	11262.45	87.439	442706.	23099.	1945850.	-495.53	409.64	11244.08
360.00	2106023.	11623.20	87.940	436858.	27489.	2060033.	-674.73	469.22	11594.11
370.00	2219900.	11997.89	88.393	429203.	32499.	2177771.	-856.90	533.75	11955.34
380.00	2337488.	12387.92	88.799	419709.	38181.	2299182.	-1042.44	603.58	12329.22
390.00	2458952.	12793.86	89.166	408338.	44588.	2424400.	-1232.84	678.79	12716.22
400.00	2584441.	13214.48	89.489	395041.	51776.	2553546.	-1427.19	759.73	13115.19
410.00	2714121.	13652.21	89.771	379781.	59803.	2686753.	-1625.94	846.87	13528.56
420.00	2848169.	14108.06	90.015	362505.	68735.	2824169.	-1830.19	940.48	13957.20

TABLE II F (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	----- EARTH FIXED -----			----- EARTH FIXED POSITION AND VELOCITY VECTOR COMPONENTS -----					
	POSITION (FT)	VELOCITY (FT/S)	PATH ANGLE (DEG)	X (FT)	Y (FT)	Z (FT)	DX (FT/S)	DY (FT/S)	DZ (FT/S)
430.00	2986773.	14583.32	90.222	343158.	78636.	2965952.	-2040.20	1041.01	14402.33
440.00	3130144.	15080.79	90.391	321681.	89500.	3112282.	-2256.61	1149.13	14866.66
450.00	3278497.	15598.91	90.526	298063.	101644.	3263343.	-2480.36	1264.87	15348.41
460.00	3432048.	16139.91	90.625	272052.	114906.	3419318.	-2711.13	1389.10	15849.83
470.00	3591035.	16705.93	90.689	243754.	129456.	3580414.	-2950.04	1522.34	16372.78
470.25	3595082.	16719.98	90.691	243016.	129837.	3584508.	-2956.16	1525.70	16385.70
480.00	3755277.	17209.63	90.797	212992.	145292.	3746416.	-3203.97	1645.99	16828.45
490.00	3924521.	17732.65	90.876	179648.	162401.	3917042.	-3466.23	1777.14	17299.54
500.00	4098983.	18278.17	90.921	143641.	180863.	4092471.	-3736.63	1916.64	17789.20
510.00	4278894.	18847.87	90.935	104885.	200767.	4272894.	-4010.25	2065.95	18298.74
520.00	4464502.	19443.86	90.920	63281.	222216.	4458520.	-4306.59	2225.61	18829.86
530.00	4656077.	20068.42	90.876	18715.	245317.	4649572.	-4608.72	2396.31	19384.50
540.00	4853910.	20724.23	90.803	-28937.	270181.	4846299.	-4924.63	2578.58	19964.93
550.00	5058333.	21417.11	90.702	-79815.	296933.	5048980.	-5254.59	2773.64	20576.42
560.00	5269720.	22148.30	90.577	-134090.	325698.	5257936.	-5603.28	2981.62	21219.34
570.00	5488443.	22919.85	90.427	-191938.	356622.	5473481.	-5971.31	3206.33	21894.80
580.00	5714917.	23739.00	90.266	-253629.	389888.	5695958.	-6367.24	3448.98	22607.58
590.00	5949638.	24608.56	90.027	-319293.	425650.	5925796.	-6766.13	3705.91	23368.08
590.64	5964893.	24665.84	90.009	-323615.	428018.	5940709.	-6791.70	3722.81	23418.31
600.00	6189390.	24689.61	90.001	-388427.	463011.	6159813.	-7049.85	3745.78	23363.34
600.64	6204672.	24689.57	90.001	-392927.	465400.	6174703.	-7067.16	3746.88	23357.89

TABLE 12F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-48 STAGE FLIGHT DATA

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	VELOCITY VECTOR EARTH FIXED (DEG)	LONGITUDE (POS. EAST) (DEG)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
143.00	193452.	36.581	6631.41	45.568	36.423	-80.207	28.955	29.118
144.32	197491.	37.860	6620.71	45.567	36.432	-80.192	28.972	29.135
147.72	207657.	41.151	6554.49	45.578	36.462	-80.155	29.016	29.180
150.72	216403.	44.071	6572.89	45.547	36.503	-80.122	29.055	29.219
154.92	228362.	48.203	6617.20	45.465	36.535	-80.075	29.110	29.274
160.00	242395.	53.272	6675.25	45.356	36.562	-80.018	29.178	29.342
166.48	259454.	59.865	6756.05	45.222	36.599	-79.943	29.266	29.431
166.62	260032.	60.015	6757.99	45.219	36.600	-79.941	29.268	29.433
170.00	268728.	63.506	6804.61	45.148	36.618	-79.901	29.315	29.480
171.75	273162.	65.332	6829.68	45.111	36.627	-79.881	29.339	29.504
180.00	293395.	74.083	6951.77	44.916	36.638	-79.781	29.456	29.621
190.00	316669.	84.991	7105.43	44.707	36.656	-79.656	29.602	29.768
200.00	338670.	96.229	7271.37	44.526	36.701	-79.528	29.752	29.918
210.00	359417.	107.809	7448.89	44.375	36.775	-79.395	29.907	30.073
220.00	378930.	119.743	7638.08	44.258	36.882	-79.257	30.066	30.233
230.00	397234.	132.041	7838.24	44.171	37.016	-79.115	30.229	30.397
240.00	414351.	144.715	8049.88	44.112	37.175	-78.967	30.398	30.566
250.00	430305.	157.778	8272.57	44.077	37.356	-78.814	30.571	30.740
260.00	445119.	171.241	8506.48	44.067	37.558	-78.656	30.749	30.918
270.00	458821.	185.119	8752.98	44.078	37.778	-78.492	30.932	31.102
280.00	471429.	199.428	9011.02	44.110	38.016	-78.321	31.120	31.290
290.00	482970.	214.181	9281.14	44.163	38.271	-78.143	31.313	31.484
300.00	493468.	229.395	9563.32	44.235	38.542	-77.959	31.511	31.683
310.00	502950.	245.085	9857.03	44.326	38.828	-77.767	31.715	31.888
320.00	511448.	261.269	10163.01	44.437	39.129	-77.568	31.925	32.098
330.00	518990.	277.961	10481.17	44.565	39.444	-77.360	32.140	32.314
340.00	525610.	295.183	10813.61	44.712	39.774	-77.144	32.361	32.535
350.00	531337.	312.954	11159.68	44.876	40.117	-76.918	32.588	32.763
360.00	536199.	331.294	11516.97	45.058	40.474	-76.684	32.821	32.997
370.00	540236.	350.225	11892.17	45.257	40.845	-76.439	33.060	33.237
380.00	543490.	369.767	12280.67	45.474	41.230	-76.183	33.306	33.483
390.00	546002.	389.946	12685.45	45.707	41.627	-75.917	33.558	33.736
400.00	547811.	410.785	13104.05	45.959	42.038	-75.638	33.817	33.995
410.00	548971.	432.309	13540.14	46.228	42.464	-75.348	34.082	34.261
420.00	549531.	454.546	13994.31	46.515	42.903	-75.044	34.355	34.534

TABLE 12F (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING

FLIGHT TIME (SEC)	ALTITUDE (FT)	RANGE (NM)	S-4B STAGE FLIGHT DATA			LONGITUDE (POS. EAST)	GEOCENTRIC DECLINATION (DEG)	GEODETIC LATITUDE (DEG)
			RELATIVE VELOCITY (FT/S)	VELOCITY VECTOR SPACE FIXED (DEG)	AZIMUTH EARTH FIXED (DEG)			
430.00	549545.	477.526	14467.83	46.820	43.357	-74.726	34.634	34.815
440.00	549075.	501.281	14963.53	47.143	43.827	-74.393	34.921	35.102
450.00	548178.	525.848	15479.82	47.465	44.312	-74.045	35.216	35.397
460.00	546925.	551.260	16018.96	47.847	44.813	-73.681	35.518	35.700
470.00	545393.	577.556	16583.06	48.230	45.331	-73.298	35.827	36.010
470.25	545352.	578.225	16597.06	48.249	45.344	-73.288	35.835	36.018
480.00	543558.	604.709	17084.92	48.612	45.831	-72.898	36.144	36.328
490.00	541378.	632.681	17606.06	49.013	46.347	-72.481	36.468	36.652
500.00	538935.	661.507	18149.64	49.434	46.881	-72.045	36.799	36.983
510.00	536318.	691.225	18717.34	49.877	47.435	-71.596	37.136	37.321
520.00	533618.	721.875	19311.28	50.343	48.010	-71.114	37.480	37.666
530.00	530931.	753.502	19933.72	50.833	48.606	-70.616	37.831	38.018
540.00	528361.	786.154	20587.35	51.346	49.224	-70.095	38.190	38.377
550.00	526024.	819.883	21278.00	51.883	49.865	-69.548	38.555	38.743
560.00	524033.	854.751	22006.89	52.445	50.528	-68.974	38.928	39.116
570.00	522518.	890.818	22776.45	53.039	51.222	-68.372	39.308	39.497
580.00	521549.	928.155	23592.75	53.665	51.946	-67.738	39.696	39.885
590.00	521383.	966.837	24459.81	54.313	52.690	-67.071	40.091	40.281
590.64	521409.	969.350	24516.94	54.355	52.738	-67.027	40.117	40.306
600.00	521854.	1006.343	24539.13	54.845	53.217	-66.380	40.489	40.679
600.64	521884.	1008.862	24538.99	54.836	53.249	-66.336	40.514	40.704

TABLE 13F
APOLLO SOYUZ TEST PROJECT
TYPICAL LAUNCH WINDOW CLOSING
S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
143.00	-63.756	-0.060	-0.005	-0.008	-0.017	-0.004	-0.044	-0.060	-0.005
144.32	-63.810	-0.045	-0.018	-0.004	-0.015	-0.015	-0.098	-0.045	-0.018
147.72	-64.023	1.214	-0.113	-0.004	-0.308	-0.066	-0.311	1.214	-0.111
150.72	-63.727	-0.948	-0.403	-0.144	-0.352	-0.300	-0.012	-0.949	-0.403
154.92	-63.436	-0.307	-0.204	-0.007	-0.110	-0.144	-0.275	-0.307	-0.203
160.00	-63.564	-0.262	-0.313	-0.018	-0.022	-0.045	-0.148	-0.261	-0.314
166.48	-63.628	-0.346	-0.356	-0.006	-0.022	-0.002	-0.086	-0.345	-0.356
166.62	-63.628	-0.349	-0.356	-0.006	-0.022	-0.001	-0.085	-0.349	-0.356
170.00	-63.653	-0.406	-0.471	-0.010	-0.009	-0.066	-0.061	-0.406	-0.472
171.75	-63.671	-0.416	-0.596	-0.011	-0.003	-0.059	-0.043	-0.416	-0.596
180.00	-56.945	-1.794	-0.011	-0.960	-0.133	-0.443	-1.057	-0.633	-0.038
190.00	-56.447	-1.143	-0.604	-0.076	-0.055	-0.002	-0.037	-0.537	-0.605
200.00	-57.434	-0.596	-0.768	-0.131	-0.054	-0.033	-0.112	-0.538	-0.768
210.00	-58.385	-0.119	-0.473	-0.089	-0.072	-0.059	-0.063	-0.571	-0.473
220.00	-59.437	-0.796	-0.064	-0.097	-0.064	-0.055	-0.045	-0.570	-0.065
230.00	-60.308	1.417	-0.630	-0.091	-0.060	-0.056	-0.060	-0.573	-0.632
240.00	-61.377	1.991	-0.513	-0.134	-0.054	-0.032	-0.099	-0.571	-0.517
250.00	-62.321	2.533	-0.274	-0.092	-0.053	-0.023	-0.061	-0.576	-0.277
260.00	-63.334	3.046	-0.030	-0.108	-0.050	-0.025	-0.080	-0.579	-0.035
270.00	-64.616	3.523	-0.254	-0.107	-0.048	-0.024	-0.053	-0.585	-0.251
280.00	-65.597	4.004	-0.476	-0.105	-0.047	-0.023	-0.078	-0.588	-0.470
290.00	-66.729	4.462	-0.715	-0.111	-0.045	-0.023	-0.076	-0.593	-0.709
300.00	-67.833	4.911	-0.643	-0.114	-0.043	-0.055	-0.066	-0.597	-0.637
310.00	-68.783	5.361	-0.059	-0.106	-0.044	-0.057	-0.076	-0.608	-0.052
320.00	-69.894	5.793	-0.507	-0.109	-0.043	-0.057	-0.071	-0.614	-0.514
330.00	-70.944	6.223	-0.547	-0.100	-0.044	-0.042	-0.057	-0.624	-0.554
340.00	-72.218	6.622	-0.089	-0.145	-0.038	-0.048	-0.113	-0.624	-0.103
350.00	-73.383	7.046	-0.347	-0.115	-0.048	-0.043	-0.027	-0.627	-0.344
360.00	-74.393	7.466	-0.737	-0.106	-0.040	-0.037	-0.027	-0.627	-0.734
370.00	-75.473	7.863	-0.215	-0.109	-0.039	-0.052	-0.029	-0.636	-0.211
380.00	-76.626	8.246	-0.306	-0.137	-0.035	-0.050	-0.062	-0.640	-0.315
390.00	-77.031	8.623	-0.807	-0.093	-0.042	-0.037	-0.000	-0.661	-0.010
400.00	-78.801	9.032	-0.256	-0.114	-0.037	-0.057	-0.034	-0.662	-0.262
410.00	-79.975	9.402	-0.313	-0.118	-0.037	-0.057	-0.033	-0.668	-0.307
420.00	-81.147	9.766	-0.540	-0.116	-0.036	-0.024	-0.029	-0.677	-0.536

TABLE 13 F (Continued)
 APOLLO SOYUZ TEST PROJECT
 TYPICAL LAUNCH WINDOW CLOSING
 S-4B STAGE FLIGHT DATA

FLIGHT TIME (SEC)	VEHICLE ATTITUDE ANGLE			VEHICLE ATTITUDE RATE			VEHICLE ATTITUDE ERROR		
	PITCH (DEG)	YAW (DEG)	ROLL (DEG)	PITCH (DEG/S)	YAW (DEG/S)	ROLL (DEG/S)	PITCH (DEG)	YAW (DEG)	ROLL (DEG)
430.00	-82.309	10.128	-0.296	-0.117	-0.036	-0.025	-0.031	-0.685	-0.291
440.00	-83.566	10.466	-0.054	-0.120	-0.035	-0.025	-0.029	-0.695	-0.049
450.00	-84.690	10.834	-0.204	-0.110	-0.036	-0.026	-0.019	-0.704	-0.208
460.00	-85.845	11.180	-0.466	-0.118	-0.034	-0.026	-0.023	-0.712	-0.471
470.00	-87.030	11.516	-0.731	-0.119	-0.034	-0.027	-0.023	-0.722	-0.737
470.25	-87.059	11.524	-0.738	-0.119	-0.034	-0.027	-0.023	-0.722	-0.744
480.00	-88.227	11.931	-0.940	-0.113	-0.021	-0.041	-0.015	-0.709	-0.944
490.00	-89.334	12.156	-0.529	-0.106	-0.030	-0.041	-0.006	-0.735	-0.531
500.00	-90.412	12.503	-0.118	-0.113	-0.037	-0.041	-0.013	-0.749	-0.122
510.00	-91.546	12.875	-0.292	-0.118	-0.029	-0.041	-0.026	-0.745	-0.286
520.00	-92.767	13.194	-0.655	-0.118	-0.032	-0.023	-0.015	-0.757	-0.652
530.00	-93.958	13.490	-0.418	-0.122	-0.027	-0.024	-0.019	-0.758	-0.414
540.00	-95.192	13.745	-0.178	-0.124	-0.024	-0.024	-0.019	-0.763	-0.173
550.00	-96.538	13.896	-0.069	-0.146	-0.016	-0.025	-0.038	-0.766	-0.078
560.00	-97.829	14.168	-0.310	-0.110	-0.046	-0.023	-0.014	-0.808	-0.307
570.00	-100.235	14.693	-0.593	-0.282	-0.024	-0.030	-0.004	-0.765	-0.593
580.00	-100.226	14.671	-0.781	-0.015	-0.004	-0.018	-0.145	-0.760	-0.744
590.00	-100.089	14.614	-0.880	-0.000	-0.000	-0.057	-0.127	-0.772	-0.848
590.64	-100.090	14.613	-0.844	-0.001	-0.000	-0.057	-0.127	-0.773	-0.811
600.00	-100.091	14.613	-0.304	-0.000	-0.000	-0.058	-0.125	-0.773	-0.271
600.64	-100.091	14.614	-0.267	-0.000	-0.000	-0.058	-0.125	-0.773	-0.234

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APPROVAL

April 1973

PRELIMINARY FLIGHT TRAJECTORIES FOR THE
APOLLO SOYUZ TEST PROJECT

By

Joe D. Brooks

The information in this report has been reviewed for security classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

This report has also been reviewed and approved for technical accuracy.

Joe D. Brooks
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Performance and Safety
Analysis Section

APPROVAL:

E. D. Geissler
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